Department of Labor • Mine Safety and Health Administration • Joseph A. Holmes Safety Association

BULLETIN

January - February 2008

Cover:
State of West Virginia
Mine Rescue Team
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The Department of Labor, Mine Safety and Health Administration and Joseph A. Holmes Safety Association Bulletin contains safety articles on a variety of subjects: fatal accident abstracts, studies, posters, and other health and safety-related topics. This information is provided free of charge and is designed to assist in presentations to groups of mine and plant workers during on-the-job safety meetings. For more information, visit the MSHA home page at www.msha.gov.

Please Note: The views and conclusions expressed in Bulletin articles are those of the authors and should not be interpreted as representing official policy or, in the case of a product, representing endorsement by the Mine Safety and Health Administration or National Institute for Occupational Safety and Health.

Cover page: Photograph by Donald Starr; DOL/MSHA/NMHSA/AVMDB/Graphics, Visual Info Spec: Images of the WV State Mine Rescue Team. If you have a potential cover photo, please send an 8"x10" print or digital image on disk at 300 dpi resolution to Donald Starr, Joseph A. Holmes Safety Association Bulletin, National Mine Health and Safety Academy, 1301 Airport Road, Beaver, West Virginia 25813-9426.

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Artisan Contracting, Inc. Named Contractor of the Year

From left to right: Brian Bauman, Corporate Safety Director, Artisan Contracting, Inc.; Jesse Gegg, Field Safety Coordinator, Artisan Contracting, Inc.; Thomas Halstead, Field Safety Coordinator, Artisan Contracting, Inc.; Dave Figge, Vice President, Artisan Contracting, Inc.; Larry Frankum, President, Artisan Contracting, Inc.; Steven R. Rowley, President and Chief Executive Officer, Eagle Materials, Inc.; Frank Green, Vice President Engineering and Technology, Eagle Materials, Inc.; Jerry Crittenden, Plant Manager, Illinois Cement Company. Not pictured: Janie Okenfuss, Safety Manager, Artisan Contracting, Inc.

On September 4, 2007, Mine Safety and Health Administration, in alliance with the International Union of Operating Engineers and the International Association of Bridge, Structural, Ornamental, and Reinforcing Iron Workers, presented the first annual Mine Construction Maintenance and Repair's Safety Contractor of the Year Award to Artisan Contracting, Inc., of Cape Girardeau, MO.

Eligible contractors located throughout the United States were nominated. Artisan Contracting was nominated by Illinois Cement Company located in LaSalle, IL. Illinois Cement Company is a Division of Eagle Materials Inc., located in Dallas, Texas.

Mr. Larry Frankum President of Artisan Contracting Inc., stated, "While it is gratifying to receive a wonderful award such as this, we must not forget how fragile a good safety record is. We must constantly remain diligent in pursuit of maintaining safe work sites."

Your assistance is needed in the nomination process of the Contractor of the Year Award that will be presented at the 2008 Construction, Maintenance, and Repair Workshop on September 9 – 11, 2008, at the National Mine Health and Safety Academy located in Beaver, WV. Please tear out the nomination form and make as many copies as needed. All nomination forms must be submitted no later than August 1, 2008.

The Alliance of MSHA, Ironworkers, and IUOE will sponsor the award of a traveling trophy. Their goal is to utilize this trophy to recognize contractors who have demonstrated an outstanding commitment to safety through dedication to training, commitment to safety programs, or innovation in safety presentations.
The Alliance is confident that HSA members work with these contractors on a daily basis and therefore have a great familiarity with their safety climate. With that in mind, the Alliance would like to request that councils nominate contractors in their area who have demonstrated an admirable attitude toward achieving safety goals.

Submit all nominations to:
Mr. Thomas Bonifacio
CMR Workshop Coordinator
National Mine Health and Safety Academy
1301 Airport Road
Beaver WV 25813
Telephone: 304-256-3357

Congratulations

Artisan
contracting

Alliance Contractor of the Year Award Nomination Form

The Joseph A. Holmes _____Council hereby nominates the following company for recognition under the Alliance Contractor of the Year Award Program.

Company Name: _____

Contractor ID Number: _____

We make this nomination because we feel that this company has demonstrated an outstanding commitment to safety during the year. Following is a description of the safety efforts made by this company which demonstrate that commitment:

Person Completing Application: _____

Telephone: _____

Mail Completed Application no later than August 1, 2008 to:

Mr. Thomas Bonifacio
CMR Workshop Coordinator
National Mine Health and Safety Academy
1301 Airport Road
Beaver, WV 25813- 9426

Cold Weather Safety

Recognizing and Preventing Frostbite and Hypothermia

By RED, Inc. Communications

When you're outdoors this winter enjoying activities such as skiing, sledding, ice fishing, hunting, or camping, remember to keep cold weather safety in mind. For many of us, frostbite and hypothermia don't seem like serious business, but if you enjoy winter activities or travel during the cold months, exposure to cold weather can become a dangerous health risk.

According to the Mayo Foundation for Medical Education and Research (MFMER), nearly 700 people in the United States die from hypothermia each year. Thousands more suffer from frostnip and frostbite during the cold weather season. Those at the highest risk are the elderly, those who are ill, the very young, those with substance abuse problems, and people with impaired mental ability. In addition to prolonged exposure to cold temperatures, immersion in cold water significantly increases your risk of frostbite and hypothermia.

Frostnip vs. Frostbite

Frostnip is not uncommon, is generally reversible, and is not much fun. It typically appears first on the cheeks, earlobes, fingers, and toes. Frostnip causes numbness and the appearance of white, waxy skin with the top layer of skin feeling hard and the deeper tissue feeling rubbery but still soft.

Frostbite is the most common cold-related injury. Forms of frostbite can range from superficial to serious. Symptoms occur when part of the body is exposed to freezing temperatures (typically 20° Fahrenheit or 7° Celsius) and wet environments for an extended period of time. Again, as is the case with frostnip, ears, cheeks, fingers, and toes are the most susceptible areas. Frostbite victims may experience tingling or numbness in the affected area, waxy-feeling skin, pain, bright red or purple areas that are warm or cool to the touch, slow or rapid swelling and blistering of the skin, and grey or black discoloration. Frostbite can be

extremely dangerous and can even require amputation of the affected area if deep injury occurs.

What is Hypothermia?

Hypothermia results from the failure of the body's control mechanisms to maintain a normal body temperature. In warm-blooded animals, core body temperature is maintained at or near a constant level through biological homeostasis. When the body is exposed to colder temperatures, its internal mechanisms may fail to replenish the heat that is being lost to the body's external surroundings.

Stage 1 of hypothermia begins when body temperature drops 1 to 2 degrees from the normal 98.6 and mild shivering begins. The blood vessels m the outer extremities contract, restricting heat loss to the air outside. Quick and shallow breathing occurs. One may experience goose bumps, the body's way of creating an insulating layer of air by raising the hair. Most people have experienced this phenomenon but are unaware that it may be Stage 1 of hypothermia.

Stage 2 of hypothermia occurs when the body's temperature drops an additional 2 to 4 degrees Fahrenheit. Shivering becomes more violent and uncontrollable. Further contraction of surface blood vessels occurs as the body focuses all remaining resources on keeping vital organs warm. Paleness occurs, and lips, ears, fingers, and toes become blue.

If the body's temperature drops below 90° Fahrenheit, cellular metabolic processes begin to shut down, major organs fail, and clinical death occurs. These occurrences are indicative of Stage 3 hypothermia.

An Ounce of Prevention

If you plan to be out in the cold for a while, take the following measures to reduce overexposure to extreme cold and to prevent frostnip, frostbite, and hypothermia:

- **Layer, layer, layer! You can always take off some of the layers. Loose-fitting, layered, warm clothing is best.**
- **Remember to wear well-insulated, waterproof boots and thick socks.**
- **Wear mittens rather than gloves; they actually provide more warmth.**
- **Most body heat is lost through the head, so don't forget your hat, and find one that covers your ears!**
- **Wear fabric that can wick away the moisture from perspiration, as hypothermia can occur if you get wet and then cool down.**
- **Cover everything when you're exposed to the extreme cold; exposed skin can take as little as 30 seconds to become frostbitten.**
- **Get out of wet clothing immediately, and warm up with dry clothing or a blanket.**
- **Stay away from frozen and unstable bodies of water.**

- **Keep a close eye on the weather, adhere to travel advisories or weather watches, and pay attention to winter storm alerts while traveling.**
- **If you're cold and wet and can move indoors, do so, and don't wait!**

Treatments for both frostbite and hypothermia vary according to severity and stage. If you suspect someone has either of these conditions, seek professional care immediately.

References

Curtis, R. (2002). Outdoor action guide to hypothermia and cold weather injuries. Princeton University and National Ag Safety Database. (http://www.cdc.gov/NASD/docs/d001201-d001300/d001216/d001216.html).

Mayo Foundation for Medical Education and Research (MFMER). (2005). Hypothermia. (http://www.mayoclinic.com/health/hypothermia/DS00333).

MoonLily. (2006). Cold weather safety: Hypothermia and frostbite. (http://moonlily.com/nanny/articles/coldweathersafety.html).

Wikipedia, the Free Encyclopedia. (2006). Hypothermia. (http://en.wikipedia.org/wiki/Hypothermia).

Tool Box Safety Talk

by Belinda Browning

Location: _____ Supervisor: _____

Date: _____ Time: _____ Duration: _____

HYPOTHERMIA – The Unseen Enemy

1. What Is Hypothermia?
   - Lower than normal body temperature. Hypothermia occurs when your body loses more heat than it can generate.
2. What causes hypothermia?
   - Not wearing sufficient protective clothing when working outside can lead to hypothermia.
   - Wearing wet or damp clothing while working outside can also lead to hypothermia.
   - Insufficient hydration (not drinking enough liquids) can lead to hypothermia. NOTE: Studies show that persons who are under the influence of alcohol are more susceptible to hypothermia.
   - You can get hypothermia by working when you are overly tired or by working in damp and/or windy conditions. REMEMBER: Anyone working outside is subject to hypothermia.
3. What Are Hypothermia's Symptoms?
   - Weakness
   - Loss of coordination
   - Confusion
   - Drowsiness
   - Cold or pales skin
   - Uncontrollable shivering
   - Slowed heart rate
   - Slowed breathing rate
4. How Can You Prevent Hypothermia?
   - Dress warmly in layers of clothing.
   - Choose fabrics that dry quickly and allow air to move through.

- Wear clean clothing – dirty clothing does not insulate, and does not “breathe” (allow air movement and evaporation).
- Stay dry - wear waterproof and insulated boots; change your socks and shoes/boots when they get wet.
- Keep hands warm and dry; wear gloves and/or glove liners.
- Keep ears and head covered; wear a winter liner with your hard hat.
- Move indoors and warm up when your fingers and toes feel cold.
- Remember: Wind chill will affect the body’s response to cold and increase the danger of hypothermia.

5. Do you use portable heaters to stay warm? (Kerosene, Propane, Electric)
   - Some Common Hazards:
     - Carbon monoxide poisoning
     - Explosion
     - Fire
     - Hot surface
   - Heat sources capable of producing combustion shall be separated from combustible materials if a fire hazard could be created.
   - Ensure the shut off valves are working.
   - Ensure all combustible materials and chemicals are properly labeled.
   - Ensure materials are not piled/stored around the heater.
   - If tanks are used, secure them.

Attendees:

_____	_____	_____
_____	_____	_____
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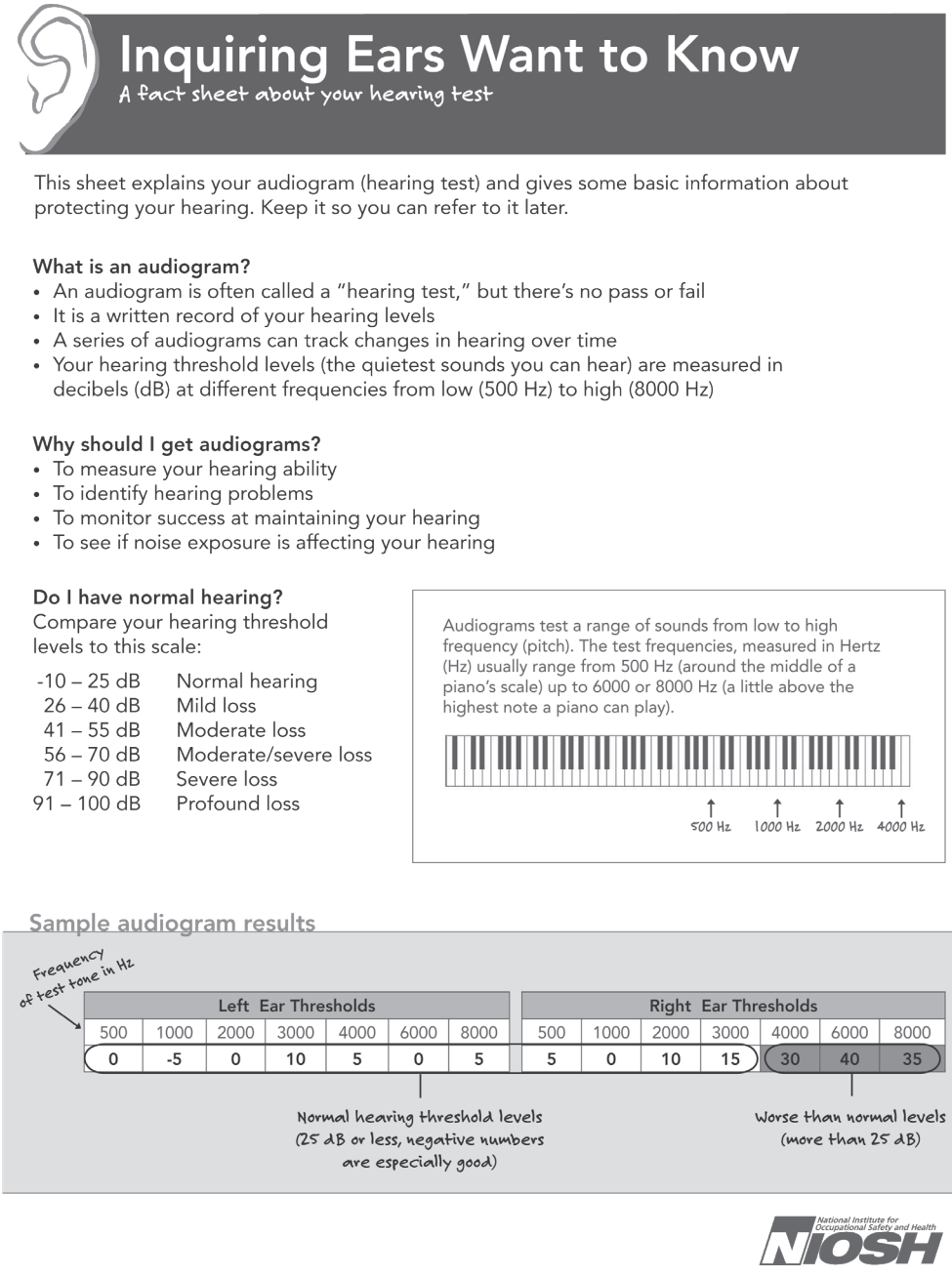
Employee Comments:

New from NIOSH: Inquiring ears want to know: A fact sheet about your hearing test

By Roberta L. Hudak, Theresa Y. Schulz, and Robert F. Randolph

Most miners these days will get an audiogram (hearing test) at some point, but what do the results mean? As NIOSH researchers, we've conducted thousands of hearing tests with miners. We noticed that the same questions keep coming up, so we compiled this fact sheet. For more details on audiograms for miners, check the MSHA publication, Audiometric Testing Reference Guide for MSHA's Occupational Noise Exposure Standard available online at www.msha.gov/1999noise/audiobook731.pdf



Inquiring Ears Want to Know

A fact sheet about your hearing test

This sheet explains your audiogram (hearing test) and gives some basic information about protecting your hearing. Keep it so you can refer to it later.

What is an audiogram?

- An audiogram is often called a "hearing test," but there's no pass or fail
- It is a written record of your hearing levels
- A series of audiograms can track changes in hearing over time
- Your hearing threshold levels (the quietest sounds you can hear) are measured in decibels (dB) at different frequencies from low (500 Hz) to high (8000 Hz)

Why should I get audiograms?

- To measure your hearing ability
- To identify hearing problems
- To monitor success at maintaining your hearing
- To see if noise exposure is affecting your hearing

Do I have normal hearing?

Compare your hearing threshold levels to this scale:

-10 – 25 dB	Normal hearing
26 – 40 dB	Mild loss
41 – 55 dB	Moderate loss
56 – 70 dB	Moderate/severe loss
71 – 90 dB	Severe loss
91 – 100 dB	Profound loss

Audiograms test a range of sounds from low to high frequency (pitch). The test frequencies, measured in Hertz (Hz) usually range from 500 Hz (around the middle of a piano's scale) up to 6000 or 8000 Hz (a little above the highest note a piano can play).

Sample audiogram results

Frequency of test tone in Hz

	Left Ear Thresholds							Right Ear Thresholds						
	500	1000	2000	3000	4000	6000	8000	500	1000	2000	3000	4000	6000	8000
	0	-5	0	10	5	0	5	5	0	10	15	30	40	35

Normal hearing threshold levels (25 dB or less, negative numbers are especially good)

Worse than normal levels (more than 25 dB)

National Institute for Occupational Safety and Health NIOSH

25th Annual Meeting
West Virginia State Council of the
Joseph A. Holmes Safety Association

The 25th Annual State Council Meeting of the Joseph A. Holmes Safety Association will convene at Oglebay Resort in Wheeling, West Virginia, on May 9, 2008. Spouse and children are welcome to attend.

AGENDA

FRIDAY, MAY 9, 2008

6:00 p.m. Registration and Reception
(Dress casual)

7:00 p.m. SESSION I
Industry Recognitions
Coal Safety Leader Nominations

SATURDAY, MAY 10, 2008

7:30 a.m. Breakfast Buffet

9:30 a.m. Golf Tournament (Golf reservations must be made by April 18, 2008 in order to participate.)

6:00 p.m. SESSION III

Banquet Speaker:
STATE MINING SAFETY AWARDS

C.A. PHILLIPS
President, West Virginia State Council

PACESETTER AWARDS

BOB CORNETT
District Manager, MSHA-CMSH District 3
Morgantown, West Virginia

BOB HARDMAN
District Manager, MSHA-CMSH District 4
Mt. Hope, West Virginia

PRESENTATION OF
COAL SAFETY LEADERS FOR 2007

LODGING AT OGLEBAY RESORT

Reservations must be made directly with Oglebay Resort. Any special needs should be made known at the time rooms are reserved. One hundred rooms have been reserved until April 1, 2008. To make reservations call toll free 800-624-6988 or go online at www.oglebay-resort.com; be sure to mention the Joseph A. Holmes Safety Association.

Council Updates

Coal River Council located in Madison, West Virginia, conducted their bi-monthly meeting on February 12, 2008. Chuck Farmer gave a presentation on Rouster Wire Rope and Rigging. Officer confirmation and our agenda for 2008 were discussed. Meetings will be held April 8, June 10, August 12, October 14, and December 9. The awards banquet will be at the Chief Logan Conference Center on April 12 and the Scholarship Golf Outing will be at Riverview C.C. on October 5, 2008. This update was submitted by Council President Dennis Wellman.

On December 11, 2007, the **Elkhorn City Chapter** (Kentucky) of the Holmes Safety Council held its quarterly meeting, with approximately 30 people attending. All aspects of coal mining were represented with surface mine operators, highwall miner operators and underground operators, were present. MSHA was well represented with both the District 6 DM and ADM. The new Miner Act and mine rescue were the main topics discussed. Kathy Friend and Dennis Mayo of KCTS were keynote speakers (KTCS Big Sandy Community & Technical College). The meeting was held at the East Ridge High School cafeteria in Pike County. The next scheduled meeting will be in March. Officers were also elected during the last meeting. This update was submitted by Leland Hess.

The Holmes Safety Association's **Indiana Council** met on October 16, 2007, for their quarterly safety meeting in Vincennes, Indiana, where 50 members were in attendance. Ron Bucci and Keith Simpson were the two guest speakers. Jeff Eyer accepted the Sentinels of Safety Award for Farmersburg Mine. LTA Awards were given to the following companies: Gibson County Coal LLC, Black Beauty Francisco Underground, Black Beauty Somerville Central, Triad Mining Freelandville Mine, Triad Mining Augusta Mine, Cave Quarries, U.S. Gypsum Shoals Mine, and Elmer Buchta Trucking. This update was submitted by Carol Helderman.

The **Great Lakes District Council** of Michigan hosted their 13th Annual Winter Workshops in January. The meetings were held in Marquette, Gaylord, Dundee, and Grand Rapids, Michigan. Each meeting consisted of seven presentations covering various safety and health topics. This update was provided by Jeff Hoblick.

The **Northwest Ohio Council** meeting was hosted by Sparks Tire with twenty-one people in attendance. They met January 15th in Findlay, Ohio. Todd Hayward of United Sales made an excellent presentation on Fall Protection with handouts and equipment samples. The Hebron Spring Thaw Workshop agenda was distributed and will be held on March 6, 2008. This update was provided by Jeff Hoblick.

South Texas Valley Council met in McAllen, Texas, on January 24. Laman Lankford presented Certificates of Honor for no fatalities or serious accidents and no fatalities for the small mines Holmes group to the following recipients: U.S. Clay, Vesuvius, Varmicon, and Martin Marietta. This update was provided by Laman Lankford.

Texas State Council meeting will be held in early September. Check out their website and newsletter at: http://www.utexas.edu/cee/txmshp/. This update was provided by Laman Lankford.

Event Schedule:

March 25-27, 2008 - South Central Joint Mine Health & Safety Conference
Oklahoma City, OK
http://www.utexas.edu/cee/txmshp/conference/index.html

April 9, 2008 – North Central Holmes Council Meeting (Texas)

April 10, 2008 – Heart of Texas – Holmes Council Meeting in Waco, TX.

April 9-10, 2008 - 31st North Carolina Mine Safety and Health Conference: Safety - Good as Gold
For more information, contact: NC Dept of Labor Mine & Quarry Bureau: 919-807-2790

May 9-10, 2008 - 25th Annual WV State Council Meeting, Oglebay, WV
For more information, call Cindy at 304-255-6853

May 12-15, 2008 - 2008 Critical Issues Conference, Daytona Beach, FL
For more information, contact info@ismsp.com or 706-253-3675

June 10-13, 2008 - 2008 National Joseph A. Holmes Conference, Lake George, NY
For more information, contact smckenna@catamountconsultingllc.com or call Jessica at 518-623-2352

June 9-13, 2008 - 12th U.S. / North American Mine Ventilation Symposium, Reno, Nevada
For more information, call: 775-784-6959 or 559-452-0182

June 17-18, 2008 - 2nd Annual Conference for the Mining Industry (substance abuse in the mines), Salt Lake City, UT
http://www.msha.gov/events/SCTraining PreventSubAbuseInMining.pdf

July 15-17, 2008 – National MNM Mine Rescue Contest, Reno/Sparks Convention Center, Reno, NV
Entry forms will also be available on MSHA's homepage under the "Mine Rescue" heading at www.msha.gov, by a written request or by e-mail to:
Metal and Nonmetal Mine Safety and Health Administration
1100 Wilson Boulevard, Arlington, VA 22209
Telephone Number: (202) 693-9609
E-mail: Mayhugh.Christine@dol.gov

September 9 -11, 2008 - 1st Annual MNM Electrical Trouble Shooting Contest National Mine Health and Safety Academy, Beaver, WV.
For more information contact Tom Bonifacio 304-256-3357

September 9 -11, 2008 - 1st Annual Cutting and Welding Contest, National Mine Health and Safety Academy, Beaver, WV.
For more information contact Tom Bonifacio 304-256-3357

September 9 -11, 2008 – Construction, Maintenance and Repair Seminar
National Mine Health and Safety Academy, Beaver, WV.
For more information contact Tom Bonifacio 304-256-3357 www.msha.gov

October 14-15, 2008 – TRAM: Training Resources Applied to Mining Conference
National Mine Health and Safety Academy, Beaver, WV.
For more information, contact Belinda Browning 304-256-3326

The **2008 Metal and Nonmetal National Mine Rescue Contest** will be held at the Reno/Sparks Convention Center in Reno, Nevada on July 15 – 17, 2008.

Events

The Miner's Lunch Pail

Pepperoni Roll Heaven in West Virginia

By RED, Inc. Communications

What the heck is a pepperoni roll? Well, if you don't come from West Virginia, you probably won't know about this portable, rib sticking, unique, ready-to-eat, fresh baked sandwich type delight.

The pepperoni roll was first made in Fairmont, West Virginia, sometime between, 1927 and the 1940s. Although the date is disputed, there is no dispute that the first rolls were invented and baked by Giuseppe "Joseph" Argiro at the Country Club Bakery in Fairmont, West Virginia. Argiro, a former miner, noticed many of his coworkers lunching on pieces of bread with sticks or slices of pepperoni. He decided to try making rolls with the pepperoni slices already baked inside. This was a sturdy, portable lunch, and by the 1940s was well-established fodder amongst the miners.

The pepperoni roll bears a resemblance to the sausage roll or "pasty," a similar roll/meat product that originated in the mining communities of Great Britain. It also resembles the popular Italian calzone in ingredients but not in shape. All these foods allowed miners to break from a tiring and dirty job and consume a full meal with minimal fuss. Pepperoni and other Italian foods became popular in north-central West Virginia in the early 1900s, during a time in which booming railroads and mines attracted many immigrants from Italy.

The history of the pepperoni roll gets even more interesting in 1987, when the United States Department of Agriculture (USDA) classified pepperoni roll bakeries as meat packers and threatened to shut down the small family-owned businesses that produced these delicious rolls. But the pepperoni roll was saved by Senator Jay Rockefeller who went to bat for the jobs of central West Virginia and fought to eliminate the Federal government's unnecessary regulations that would put an end to the miner's unique lunch item.

You can view a copy of Senator Rockefeller's letter that rescued the pepperoni roll at: http://www.fscwv.edu/users/rheffner/pepperoniroll/legal.htm. You will also find a host of quirky facts about the pepperoni roll, more history, variations, a long list of recipes, and locations where you can buy them ready made! An easy version of this unique roll is found below, but make sure you try them all the next time you're in the wonderful state of West Virginia. The rolls can be found in virtually every grocery and convenience store throughout the state, and are readily found at local church and school fundraisers.

Bake-N-Serv Frozen Dough Pepperoni Rolls
(see www.rhodesbread.com)

INGREDIENTS:
1 loaf Rhodes® white bread dough, thawed and risen
1 tsp oregano
4 ounces pepperoni, chopped
4 ounces sharp cheddar cheese, grated
Handful parmesan cheese, grated

DIRECTIONS:
1. Thaw dough until soft and risen (about 4-5 hours at room temperature).

2. On a floured surface, roll out dough into 12" x 16" rectangle. Sprinkle oregano over dough. Spread with pepperoni and cheddar cheese.

3. Starting with long side, roll up jelly-roll style. Cut into 12 rolls. Place on a 9" x 13" pan sprayed with non-stick cooking spray.

4. Sprinkle rolls with parmesan cheese. Cover with plastic wrap that has also been sprayed. Let rise until double in size.

5. Remove wrap. Bake at 350°F for 15-20 minutes. Serve warm.

References

Wikipedia: The Free Encyclopedia. Pepperoni roll. (http://en.wikipedia.org/wiki/Pepperoni_Roll).

Bob Heffner's Pepperoni Roll Homepage. The History of the Pepperoni Roll. (http://www.fscwv.edu/users/rheffner/pepperoniroll/history.htm).

West Union-WV.com. West Union Fest 125…. (http://www.westunionfest.org/Press/pepperoni.htm).

Reducing Musculoskeletal Injuries in Rail Operations

By Sean Gallagher, PhD National Institute for Occupational Safety and Health (NIOSH) Pittsburgh Research Laboratory

Introduction

Many mines use rail transport to send their commodity to market, particularly when large volumes of mineral must travel long distances. While rail is an efficient means of transport for mineral products, rail yard operations have often been associated with high rates of musculoskeletal injuries. This is undoubtedly due to the physically demanding nature of jobs in and around rail yards at mining operations.

The keys to reducing musculoskeletal injury risk in mine rail yards are: 1) to reduce the force (or muscular effort) needed to perform tasks; 2) improve the posture of the body; and 3) reduce the duration and/or repetition of physical exertions. Rail tasks historically have been associated with high force requirements and poor positioning of the body (especially bending the torso forward) due to the size and layout of the equipment. However, recent years have seen the development of improved designs or assist devices that have reduced physical demands and/or have improved the posture in which workers can operate. The following sections describe some of the solutions developed to reduce the risk of musculoskeletal injuries in rail yards based on the principles noted above.

Switches

Throwing switches has historically been associated with a high risk of musculoskeletal injuries in rail yards. Figure 1(a) shows an old-style switch which is poorly designed and can place workers at increased risk of back injury. This switch design requires the worker to stoop down to throw the heavy switch, placing the back in a potentially unsafe position, if high forces or incorrect methods are used.

The so-called “bowtie” switch (Figure 1(b)) is a much better design from the ergonomics perspective. The bowtie switch does not require the rail yard worker to bend to the ground to throw the switch, but allows the worker to grab the switch at knee height, which can reduce back stress by up to a third compared to the old design. The long lever arm provided by the bowtie handle permits forces to be applied at a larger distance from the center of rotation of the switch, which reduces the force requirements from the worker. The worker can also use body weight and gravity to complete the switch-throwing process, which will also reduce muscular demands and the risk of injury.

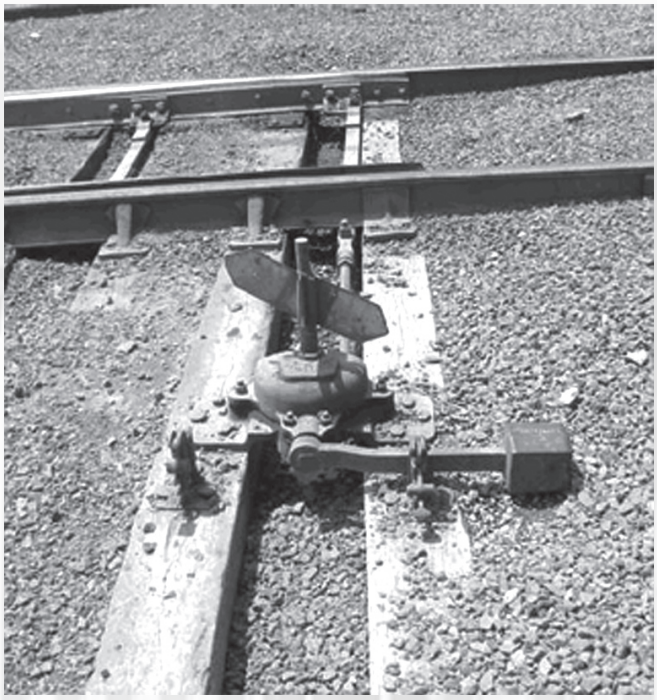
Physical demands associated with throwing switches can be eliminated entirely by using solar-powered switches (Figure 1(c)). Solar-powered switches are more expensive initially (approximately $10,000), but are becoming the standard at larger rail facilities.

Reducing Musculoskeletal Injuries in Rail Operations

Figure 1. Switch designs: (a) old-style switch requiring awkward bending, (b)"bowtie" switch, (c) solar-powered (automated) switch.

(a) old-style switch

(b) "bowtie" switch



(c) solar-powered (automated) switch.

These new switches eliminate the need to manually throw switches, as the solar-power collected is used to drive an electric motor to throw the switch. This design eliminates the risk of experiencing a costly lost-time injury due to switching. In addition to eliminating the physical demands, these new switch designs often provide other benefits, including remote control capability and remote monitoring of the switch status.

Safe operation of hand-operated rail switches requires regular maintenance. Periodic inspection, adjustment, and lubrication of switches and switch points are needed to keep forces within safe limits. Switch forces can change with the movement of trains and as the result of weather conditions. Use of point roller bearings, correct adjustment, and lubricants such as graphite or white grease (more environmentally friendly) can keep switch forces moderate.

Brake stick

Setting and releasing brakes on railcars is a common rail yard task. In the past, it was necessary to set the brake wheel by climbing up on the railcar and manually turning the wheel to set the brake. Climbing on the railcar both puts the worker at risk of a serious fall and puts the worker in a tenuous position during forceful turning of the brake wheel (Figure (2a)). Use of a brake stick (Figure 2(b)) eliminates the need to climb and hang on to the railcar when setting brakes, and permits the worker to set the brakes more quickly while safely positioned on the ground. Brake sticks permit application of adequate force with very low muscular effort by using gravity and biomechanical advantage. These devices are very popular among rail yard workers.

Figure 2. Setting Brakes (a) after Mounting railcar, (b) using brake stick.

Gate Openers

Gates for each railcar "pocket" (chutes used to dump/unload material from a railcar) are often opened using a heavy steel bar. The worker has to reposition and crank the bar repeatedly in order to open the gate. This is often performed in a hazardous bent back posture (Figure 3(a)). The risk factors of high physical force exertion and bent torso posture place the worker at high risk of back nate the need to manually throw switches, as the solar-power collected is used to drive an electric motor to throw the switch. This design eliminates the risk of back injury. Of particular concern is the unexpected loading that may occur if the bar slips free or the gate is stuck when it is expected to move (as may happen when gates are frozen). Devices are now commercially available that open

gates mechanically and which can easily open frozen or stuck gates (Figure 3b). Use of these mechanical gate openers eliminates repeated high force exertions in awkward postures when manually opening gates, reducing back injury risk.

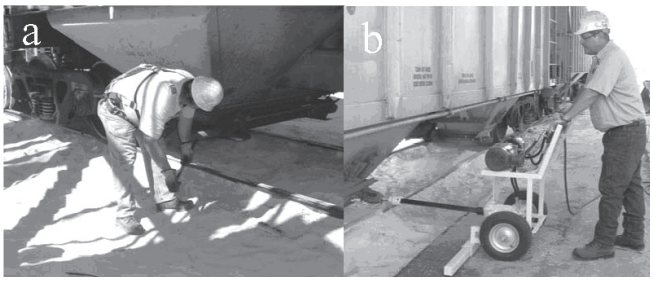


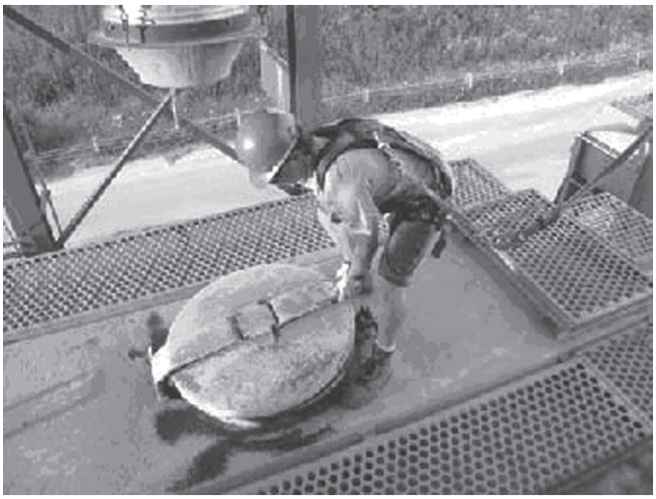
Figure 3. Opening hopper car gates (a) using steel bar and (b) using mechanical gate opener.

Hatch Opener

Some mines transport their commodity in covered hopper cars, especially when keeping the material dry is an issue. These hopper cars often have heavy steel hatches that need to be opened so that material can be loaded. Workers typically open these hatches while standing on top of the railcar which requires them to bend forward to grab one end of the hatch and lift (Figure 4(a)). This again puts the back in a hazardous posture during a heavy exertion. The bending and lifting exertion is repeated when the hatches (again laying flat on the car) need to be closed. Hatches sometimes get stuck or frozen leading to high opening forces (up to 155 pounds!).

Figure 4. Opening covered hopper car hatches (a) manually and (b) using rail hatch opener.

A prototype hatch opener assist device developed by the National Institute for Occupational Safety and Health (NIOSH) is currently being field tested. This device allows the worker to maintain a more upright posture when opening the hatch, and props the hatch open for loading (Figure 4b). Propping the hatch open greatly reduces the stresses associated with closing hatches and the hatch opener can be used to easily control the closing of the hatch. An analysis using a low-back



biomechanical model (Chaffin 1997) indicated that low back stress is reduced by approximately 30% when using the device (compressive forces on the low back were 1193 pounds when lifting the hatch by hand versus 835 pounds when using the hatch opener).

Latch opener assist tool

Opening the hatches on covered hopper cars requires releasing a latch that is under spring tension. This requires considerable force due to the short lever arm available on latch arm itself. Workers at one mine rail operation developed an assist device that can be used to effectively increase the lever arm (and the mechanical advantage) available to unload the spring tension on the latch, decreasing

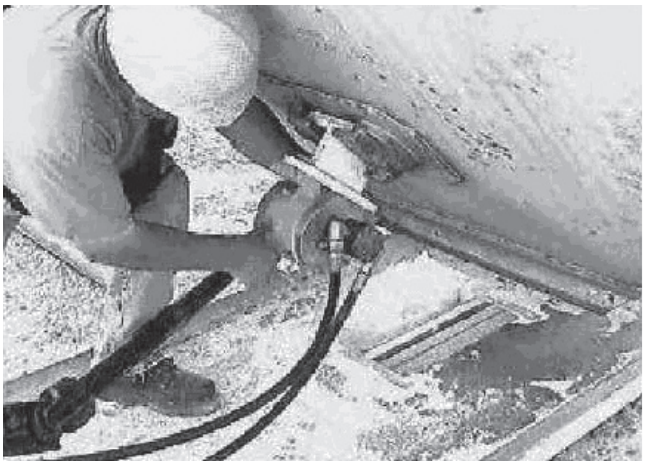
Figure 5. Latch opener assist tool.

the force needed for this task. Figure 5 shows an example of a worker using this device.

Installing railcar shakers

Railcar shakers are sometimes used to help clean out railcars. Shakers are quite heavy (approximately 40-50 pounds) and manual installation on the railcar requires use of a bent back posture creating high stress on the low back (Figure 6(a)). However, carts to facilitate shaker installation have been developed to avoid having to handle or lift the shakers. Figure 6(b) shows an example (American Portland Cement Alliance, 2002). The cart is wheeled up to the hopper car that needs to be cleaned out and is tilted into place. The cart shown below was fabricated by an on-site company shop. Similar (more sophisticated) devices of this sort are commercially available from rail safety suppliers. Eliminating the need to manually lift a heavy railcar shaker greatly reduces low back injury risk.

Figure 6. (a) Manual installation of railcar shaker, and (b) cart developed to install railcar shaker without manual lifting.



Rail yard storage and organization

The author has visited a number of rail operations where frequently used items were poorly stored and the yard disorganized. In many cases, heavy pieces of equipment (hoses, shakers, and other heavy items) were "stored" on the ground, which is unsafe and unproductive (Figures 7(a) and 7(b)). Lifting such items from ground level can triple the risk of a low back injury; compared

Figure 7. (a) heavy railcar shaker "stored" on the ground

Figure 7(b). Poorly organized tools and hoses.

to if they were stored at waist height. Improved storage procedures can eliminate many tripping hazards as well.

Improved organization and storage can play an important role in decreasing injury risk and improving productivity. As an example, a large

national railroad company experienced a high rate of injuries at one of its repair facilities (American Association of Railroads 1989). Of particular concern was the high incidence of back injuries, lost time, and absenteeism. For example, the year before changes were instituted at the maintenance yard, 9 of 13 lost time injuries were back injuries, and 579 lost days and 194 restricted or limited work days accumulated. Only 1,564 cars were repaired that year, and absenteeism was 4 percent. Some relatively inexpensive facility changes, such as providing tables and/or racks and better tool storage, reduced the risk of injury and made the workplace more efficient and functional. An example of improved storage can be seen in Figure 7(c). Prior to the development of the table shown, heavy coupler knuckles were tossed in a pile on the ground and had to be lifted using an awkward

Figure 7(c).. Improved rail yard organization and storage: storage table for coupler knuckles allows lifting at waist height rather than from ground.

stooping posture. The coupler knuckle storage table allowed workers to handle these heavy objects at waist height with the back in an upright posture, which can reduce the loading on the low back by up to 65% compared to lifting from the ground. As part of this effort, the company evaluated the back stress of all heavy lifting tasks, and instituted a training program on safe lifting. Over a four-year period, overall injuries decreased from 33 to 12, back incidents from 13 to 0, lost days from 579 to 0, restricted days from 194 to 40 (all non-back injuries), and absenteeism dropped from 4% to 1% (Table 1). The number of cars repaired per year increased from 1,564 in 1985 to 2,900 over this period, an increase in dollar value of $3.96 million. The company calculated the cost-benefit ratio as approximately 1 to 10 (i.e., one dollar spent on ergonomics changes resulted in 10 dollars in savings).

Summary

Rail operations have long involved heavy physical effort and work in awkward postures, both of which are major risk factors for musculoskeletal problems (particularly back injuries). However, there are many ways to reduce these risk factors, through improved design of switches, development and/or use of assist devices for physically demanding jobs, and better organization and design of rail yard facilities. As noted above, such improvements can reduce injury risk while enhancing productivity in rail operations.

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	1985[a]	1986	1987	1988
Total incidents	33	23	10	12
Reportable incidents	29	10	2	7
Lost-time incidents	13	1	0	0
Back injuries	9	0	0	0
Lost days	579	11	0	0
Restricted days	194	15	2	40[b]

[a]1985 data are typical of data for previous 4 years.
[b]Increase is in non-back-related minor injury incidents.

Table 1. Injury experience at a rail repair shop before and after instituting a back injury reduction program (AAR, 1989)

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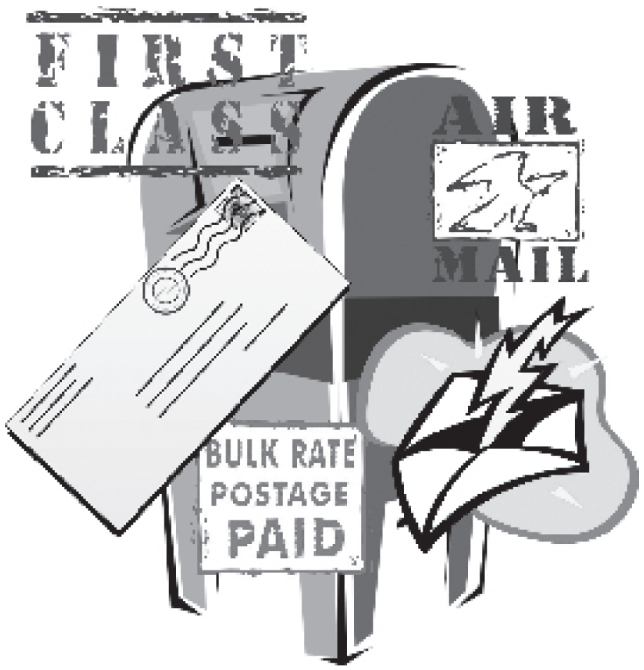

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