

Part 70 – Mandatory Health Standards for Underground Coal Mines

Comments

**Janet Torma-Krajewski, Ph.D., CIH, CPE
Industrial Ergonomics, Inc.**

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Disclaimer

- Dr. Torma-Krajewski was asked to independently review available research studies, including NIOSH publications, related to the ergonomic aspects of wearing a CPDM.
- Industrial Ergonomics, Inc. received funding from Murray Energy Corporation to conduct this independent review.
- The opinions and comments presented herein reflect the independent scientific assessment of Dr. Torma-Krajewski, not necessarily that of Murray Energy Corporation.

Concern

Miners required to frequently wear the CPDM will experience:

- Increased incidence of MSDs**
- Increased problems with balance, including falls**

MSHA Injury/Illness Data 2000-2007

- 35 percent of non-fatal lost-time injuries occurred while handling materials (lifting, pushing and pulling),
- 43.5 percent of reported injuries were sprains and strains,
- 40 percent of reported illnesses were MSDs associated with repetitive motion,
- 21.5 percent of all lost-work time involved injuries to the back, and
- The back was the most frequently reported body part injured

Aging Workforce

- 52.3 percent of mine workers were 45 or older (2006)
- 40 percent of all injuries are MSDs
- Older mine workers experience three times as many lost-time work days as do younger workers.
- With increasing age:
 - people experience declines in muscular strength and physiological capacity past the age of 35 years
 - people often develop various conditions/diseases that affect work output, such as arthritis, low back disorders/pain, and musculoskeletal disorders, past the age of 50 years.

Proposed Rule

- Miners in “designated occupations” (“DOs”) will be required to wear a CPDM every day for all shifts.
- Miners in “Other Designated Occupations” (“ODOs”) will be required to wear a CPDM for 56 days per year for all shifts. (Nearly $\frac{1}{4}$ of their work year days.)



CPDM

- Designed to be worn on the miner's belt
- Weight = 6.7 pounds
- Dimensions: 9.57 inches (W) x 3.42 inches (D) x 6.75 inches (H)



Typical Equipment Worn by Miners



Physiological / Biomechanical Effects of Carrying Loads on a Miner's Belt

- No research has evaluated the effects of
 - carrying loads on a miner's belt
 - carrying the CPDM on a miner's belt
- Research on asymmetrical loading and carrying methods

Summary – Research Studies

- Letter carriers experienced excess shoulder, neck and back disability (Wells et al., 1983)
- Lowest L5/S1 compressive forces, postural deviation, and pressure on the shoulders, and the most balanced force distribution between the feet when load carried in 2 pouches symmetrically positioned on the right and left hip, two shoulder straps that crossed diagonally on the chest, and a waist belt (Lin et al., 1996 and Dempsey et al., 1996)

Summary – Research Studies

- Significant differences in increased flexion of the hip and knee at heel contact and midswing were observed (Arellano et al., 2009)
- Increase in weight carried and the resultant increase in cardiac strain could be compensated by a redistribution of the weight (Griefahn et al., 2003)
- Increasing loads and loads placed superior to the center of mass led to less postural control and a greater risk of loss of balance or falls (Qu and Nussbaum, 2009)

NIOSH IC 9501

Miners' Views about Personal Dust

- Objective: Document coal miners' reactions to using the CPDM and how they would use the information provided by the CPDM
- Followed "Health Belief Model" described by Janz et al. 2002
- Questions asked regarding discomfort or inconvenience:
 - "Did you have any problems using the new PDM?"
 - "Can you think of any reasons why miners would NOT want to wear the new PDM?"

The authors stated that "it is important to minimize discomfort or inconvenience miners experience while wearing PDMs."

Survey Results

- Size and weight of the CPDM
- Light cord/sample hose
- Attachment of the CPDM to the miner's belt

MEC Survey Results

- 82 % experienced problems with the CPDM
- 82% experienced discomfort from carrying the CPDM
- 64% reported a greater level of fatigue while carrying the CPDM
- 55% reported problems with reading the monitor (twisting the torso to read the monitor)
- 55% reported problems with their balance while walking and carrying the CPDM
- 27% reported problems with their balance while standing and carrying the CPDM

MEC Survey Results

- 73% reported that the CPDM interfered with operating equipment
- 82% reported problems with sitting in equipment when wearing the CPDM
- 91% reported problems with the cord pulling on their hard hat
- 91% reported problems with the cord catching on equipment
- 82% identified other problems with the cord

MEC Survey Results

“The hookup on machine is not very friendly. The unit makes my neck hurt. I can't wear the unit on the mantrip and it costs me more time to hook it up to my belt. More added accessories than I need hanging around my waist. At the end of my shift my neck hurts and my upper back. My waist hurts as well due to having the unit, tool pouch and rescuer (SCSR). Afraid that I'm going to break my unit as well. The cords are in my way when lacing cable on miner and taking them off. The cord is in my way when I am backing up. Cord pulls on my neck hard when hanging curtain and cable.”



Questions?

- What is the maximum weight acceptable to miners that can be worn on the miner's belt?
- What is the maximum weight that should be worn on miners' belts from a biomechanical and physiological perspective for both low and high coal seams?
- What is the most appropriate configuration of equipment, including the CPDM, that is carried by miners to perform job tasks from a biomechanical and physiological perspective?
- Do shoulder straps reduce the impact of the object weight worn on a miner's belt in both high and low coal seams from a biomechanical and physiological perspective?
- Will wearing the CPDM on the miner's belt on a daily basis result in the development of discomfort and/or MSDs disorders?

Questions?

- Will attaching the CPDM sampling tube and light to the miner's cap on a daily basis result in the development of discomfort and/or MSDs of the neck and upper back?
- Will the repeated twisting of the neck and back to read the CPDM screen result in the development of discomfort and/or MSDs?
- Will wearing the CPDM on the miner's belt on a daily basis result in the development of greater fatigue levels?
- Will wearing the CPDM on the miner's belt on a daily basis result in the development of balance problems while standing or walking?
- Will wearing the CPDM on the miner's belt on a daily basis result in the development of gait problems while walking?
- Will wearing the CPDM on the miner's belt interfere with sitting in any mining equipment, operating any mining equipment, and or getting on and off any mining equipment?

Conclusions

- **Wearing the CPDM on the miner's belt will likely increase the risk for MSDs.**
- **Conduct research to address the issues identified by the NIOSH questionnaire and the MEC survey.**
- **Delay required use of the CPDM until these issues have been resolved.**

Questions?