



NEW MEXICO BUREAU OF MINE SAFETY

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August 2018 Newsletter

Task Exploring Fit to Improve Mine Safety: A NIOSH Project on Mobile Proximity Detection Systems

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Editor's Note: La Tasha Swanson presented on research conducted by NIOSH regarding the implementation of mobile proximity detection systems in underground coal mines at the annual Holmes Safety meeting in June . I found the Task-technology Fit model may have more wide-spread application in mining for any newly introduced technology. The following is a short overview of the research project and description of that model.

What makes people engage in unsafe behaviors? Thanks to our understanding of human behavior imparted by the experience of mine safety managers and decades of published research, we can now identify several factors that may explain why people engage in unsafe behaviors. As our awareness of the effects of factors such as personality, fatigue, and mine culture continues to grow, we may also consider one less commonly discussed factor that could influence unsafe practices. That factor is *fit*.

This article briefly summarizes how NIOSH researchers are using an instrument called *task-technology fit* to better understand the fit between proximity detection systems for mobile machines (mobile PDS) and underground coal mining.

The Current State of Mobile PDS

Mobile PDS is an automated collision avoidance system intended to decrease pinning, crushing, and striking injuries. According to MSHA, “from 1984 through 2014, 42 fatal and 179 non-fatal pinning, crushing, or striking injuries occurred in underground coal mines that may have been prevented by the use of proximity detection systems on coal hauling machines and scoops.”^[1] MSHA proposed a rule in 2015 that would require underground coal mine operators to install mobile PDS on scoops and hauling machines on all working sections.^[1] At this point, the proposed rule has not been enacted. However, due its potential safety benefits, some mine operators may be interested in adopting mobile PDS.

The Task-technology Fit Instrument

In 1995, Goodhue and Thompson introduced task-technology fit to help decision makers evaluate how information systems fit organizational tasks.^[2] Fit can be defined as a suitable quality, standard, or type that meets a required purpose. Further, task-technology fit can be described as the degree to which one finds a technology to be useful in helping with task completion.^[2] For example, consider a shuttle car operator who is focused on safely and efficiently transporting coal. If mobile PDS helps the worker to safely and efficiently transport coal, then the worker’s evaluation of mobile PDS would be more favorable than if the technology makes transporting coal more hazardous or difficult.

As shown in Figure 1, the user’s evaluation of the technology is based on three characteristics: (1) task, (2) mine, and (3) system. This figure represents a modified model of the task-technology fit instrument—the original instrument introduced by Goodhue and Thompson includes individual characteristics instead of mine characteristics. Table 1 further describes each of the characteristics.

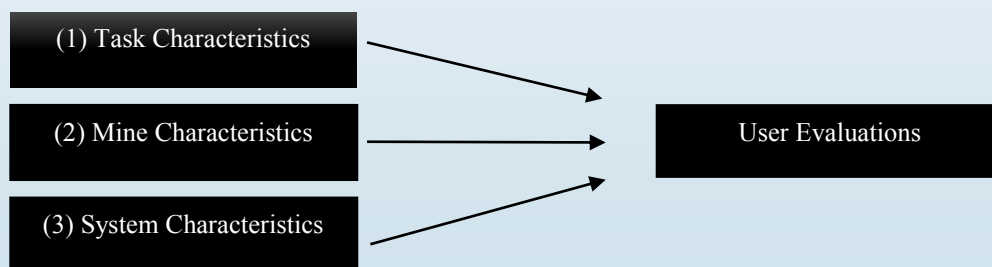


Figure 1: Characteristics of task-technology fit

Continued on Page 2

August 2018 Newsletter

From Page 1

Table 1. Explanation of the modified task-technology fit characteristics

Characteristic	Description	Example
(1) Task characteristics	Features of the job or responsibility	Cutting coal
(2) Mine characteristics	Attributes or conditions of the mine	Seam height
(3) System characteristics	Features of the system or technology	Accuracy

User evaluations are also an important part of Goodhue and Thompson’s task-technology fit.^[2] As a part of the current NIOSH study, researchers collected user evaluations by asking mine leaders to evaluate mobile PDS based on nine factors. Table 2 gives a description for each of the nine factors.

Table 2. Descriptions of task-technology fit factors for the NIOSH study

Task-technology Fit Factor	Description
(1) Training and ease of use	It is easy to use the system and get quality training
(2) Locatability	It is easy to identify system information
(3) System quality	The system gives accurate information that keeps workers safe
(4) Authorization	It is easy to get authorization to access the necessary functions of the system
(5) User experiences	Workers have positive experiences with mobile PDS in the mining environment
(6) System reliability	The PDS is dependable and consistent
(7) Safety	The system is effective and keeps workers safe
(8) Compatibility	PDS works well with other machines, systems, and the conditions of the mine
(9) Task completion	The system gives accurate information that keeps workers safe

These nine factors were developed from Goodhue and Thompson’s^[2] original eight dimensions of task-technology fit.

What We Have Learned from Mine Leaders about Mobile PDS, Safety, and Fit

With the introduction and adoption of new mining technologies that boast improved efficiencies and safety, the concept of *task fit* becomes even more critical and fundamental questions emerge. How well do these new technologies aid in the completion of mining tasks? More importantly, what are the health and safety consequences of poor task-technology fit?

To begin to explore these questions, NIOSH researchers asked mine leaders at two underground coal mines to complete surveys and participate in guided group discussions. The study included nine mine leaders, who were foremen, dust coordinators, superintendents, general managers, and automation specialists.

Preliminary results from the study provide two key findings. First, the study results show ways that mobile PDS may either fit or present challenges in the underground mining environment. Second, the study reveals task, mine, and system characteristics that may influence the way mobile PDS fits with mining.

Ways That Mobile PDS May Fit or Present Challenges

First, preliminary results show that mine leaders evaluated five of the task-technology fit factors favorably: training and ease of use, locatability, system quality, authorization, and user experiences. This finding suggests that these are areas where mobile PDS may fit well with underground coal mining. Conversely, safety, compatibility, task completion, and system reliability were evaluated less favorably, which may indicate that these areas present some challenges.

Characteristics That Influence the Fit of Mobile PDS

Second, the study results also help to describe task, mine, and system characteristics that may influence the fit between mobile PDS and coal mining. For task characteristics, results show that mobile PDS has made miners more aware of “red zones”—those areas where they might be in danger of being struck or pinned by a machine—while working. However, mine leaders report that the mobile PDS has made some tasks such as loading, dust sampling, or working near other equipment or machines more difficult or hazardous. Some of the challenges related to specific mining tasks have caused frustration for miners.

Results for mine characteristics reveal that specific mine conditions may have an influence on the performance and implementation of mobile PDS. Conditions such as seam height, humidity, amount of metal in the mine, and floor conditions seem to have an impact on how the system has performed. Both participating mines reported having to tailor the system to meet their specific

August 2018 Newsletter

From Page 2

mining conditions and environment. In addition, policies, resources, training programs, and existing culture at a mine may influence implementation efforts.

Lastly, results for system characteristics show that mobile PDS has helped to keep miners safe. However, issues related to electromagnetic interference, system alerts and feedback, and the wearability of the miner-wearable components have created several safety concerns.

Note: The above findings are based on preliminary data and should not be considered as general knowledge. Using Fit to Improve Safety

The task-technology fit method may be an effective evaluate for preliminary design prototype criteria testing to point to design deficiencies before manufacturing. For the current NIOSH study, it was assumed that the technology was appropriately designed and usability was a part of the design process. Preliminary findings from this study may help mine leaders better understand the fit between mobile PDS and underground coal mining. If mine leaders are more aware of situations where mobile PDS can support miners in safely completing tasks, then they may be more interested in adopting the technology to help prevent human-machine collisions. It is also beneficial to understand situations where mobile PDS is more challenging to use. Understanding these challenges can help leaders to make informed decisions about mobile PDS adoption and implementation as well as help manufacturers improve design features. Finally, this understanding could also help mine leaders to address and prevent unsafe behaviors such as miners removing or disabling the miner-wearable component through training, policies, and practices.

Disclaimer

The findings and conclusions in this paper are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

References

- [1] Mine Safety and Health Administration (MSHA). (2016). Proximity detection systems for mobile machines in underground mines. Retrieved from <https://www.msha.gov/regulations/rulemaking/proximity-detection-systems-mobile-machines-underground-coal-mines>. Accessed July 20, 2018.
- [2] Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS Quarterly* (19)2, 213-236.



LaTasha Swanson, PhD, serves as an Associate Service Fellow in Behavioral Sciences for the Centers for Disease Control and Prevention (CDC) National Institute for Occupational Safety and Health (NIOSH). She works in the Human Factors Branch of the Pittsburgh Mining Research Division. She uses qualitative, quantitative, and mixed-methods approaches to explore health and safety issues affecting the mining industry. She is most interested in exploring how behavior and communication influence occupational health and safety.



Jennica L. Bellanca is a Biomechanical Engineer with the National Institute for Occupational Safety and Health (NIOSH), Pittsburgh Mining Research Division (PMRD). She earned her Bachelor's degree in Bioengineering and Master's degrees in Bioengineering and Mechanical Engineering from the University of Pittsburgh in 2009 and 2011, respectively. She has worked for PMRD for 6 years, focusing her research on human factors issues related to informational needs, hazard recognition, and proximity detection. Her work has involved virtual reality (VR) environment development and training tool development.

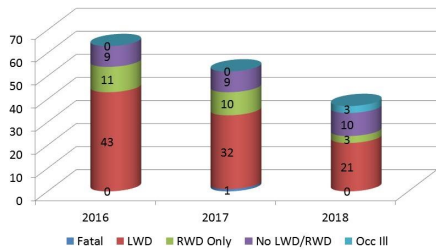


August 2018 Newsletter

New Mexico Injury Statistics for the 1st two Quarters of 2018

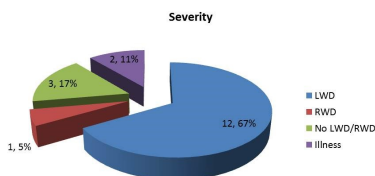
New Mexico mine operators experienced a significant decline in the number of MSHA reportable incidents (36%) during the first half of 2018 vs. the second half of 2017. Over the last three years, the first half year incidents have decreased steadily.

NM Jan-June 2016-18 MSHA Reportable Injuries and Illnesses

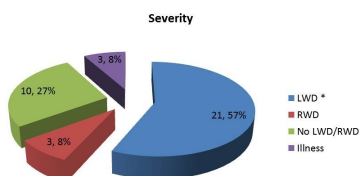


Full-sized graphs are attached to the final pages of the newsletter. However, it is interesting to note that the percentage of lost workday injuries decreased markedly from the first quarter of 2018 (67%) bringing the first half share of lost workday cases to 57% of the total. The less severe restricted workday and no lost workday cases increased accordingly.

NM 1Q 2018 MSHA Reportable (18)



NM Jan-June 2018 MSHA Reportable (37*)



*two incidents charged to contractors

Mining Safety Board

The Mining Safety Board met on June 21 at the BMS facility in Socorro. The proposed amendments to the rules for certification and recertification of coal mine officials was approved. The new rules will become effective upon filing with the state and they will be posted on the BMS website

A revised Open Meeting Act (OMA) resolution was passed, and John Prucell was selected to fill the Vice-Chair position vacated in February by the resignation of long-time member Monty Owens. nmminesafety.com



The next meeting is scheduled for 9:00 a.m. on October 30, 2018 at a location to be determined in Carlsbad.

Inquiries can be directed to Board Chair Jeff Gordon at:
jeffgordon.nmmsb@yahoo.com.

Mining - Fatal Injuries

YTD—8/09/2018: 7 M/NM; 5 Coal; 12 Total

M/NM, North Dakota

On July 31, while placing a 20-foot long steel tube onto the screen feed conveyor at a construction sand plant, a 62-year old miner was crushed between a front-end loader bucket and the screen feed conveyor structure.

“Great spirits have always encountered violent opposition from mediocre minds.” – Albert Einstein

August 2018 Newsletter

MSHA PROGRAM POLICY MANUAL—COAL



§75.301 Definitions.

Return air. Air that has ventilated the last working place on any split of any working section or any worked-out area whether pillared or nonpillared. If air mixes with air that has ventilated the last working place on any split of any working section or any worked-out area, whether pillared or nonpillared, it is considered return air. For the purposes of §75.507-1, air that has been used to ventilate any working place in a coal producing section or pillared area, or air that has been used to ventilate any working face if such air is directed away from the immediate return is return air. Notwithstanding the definition of intake air, for the purpose of ventilation of structures, areas or installations that are required by this subpart D to be ventilated to return air courses, and for ventilation of seals, other air courses may be designated as return air courses by the operator only when the air in these air courses will not be used to ventilate working places or other locations, structures, installations or areas required to be ventilated with intake air.

75.301 Definitions

30 CFR 75.301 defines return air as:

Air that has ventilated the last working place on any split of any working section or any worked-out area, whether pillared or nonpillared. If air mixes with air that has ventilated the last working place on any split of any working section or any worked-out area, whether pillared or nonpillared, it is considered return air. For the purposes of existing Section 75.507-1, air that has been used to ventilate any working place in a coal producing section or pillared area, or air that has been used to ventilate any working face if such air is directed away from the immediate return, is return air.

Title 30 CFR 75.507-1(a) states that "All electric equipment, other than power-connection points, used in return air outby the last open crosscut in any coal mine shall be permissible except as provided in paragraphs (b) and (c) of this section."

For multiple entry setups with intake entries on one side, return entries on the other side, and conveyor belt and other common entries in the center, problems have arisen in determining whether or not return air is being

coursed in the outby direction over non-permissible electric equipment in the conveyor belt entry. An acceptable method for making this determination is to measure air quantities at a location three crosscuts outby the working face in both the intake and return air courses. Taking into consideration standard anemometer error, if a comparison of these readings indicates a significant variance, a violation of 75.507 may exist.

Sulfur hexafluoride (SF6), tracer gas, should not be used as the primary means for determining compliance with this standard. If after analyzing appropriate intake and return air measurements, tracing clouds of chemical smoke, and examining the section ventilation system, a determination is made that there is a violation of 75.507-1, tracer gas may be used to substantiate the violation.

§77.705 Guy wires; grounding.

Guy wires from poles supporting high-voltage transmission lines shall be securely connected to the system ground or be provided with insulators installed near the pole end.

77.705 Guy Wires; Grounding

Guy wires attached to poles supporting high-voltage transmission lines must either be securely connected to the system ground or provided with insulators installed near the pole end as required by 30 CFR 77.705. One of the safety purposes of this requirement is to ensure that guy wires do not become energized so that a shock hazard is presented to persons on the ground. Therefore, when insulators are installed, they must be located below or extend below all high-voltage lines supported by the pole.

The in-line insulator, if used, should be at least 8 feet from the ground, according to the National Electrical Safety Code, 1973.

A guy wire connected to a pole butt ground which is not connected to the system ground would be an example of noncompliance with this Section.

MSHA PROGRAM POLICY MANUAL—M/NM



§56.15001 First-aid materials.

Adequate first-aid materials, including stretchers and blankets, shall be provided at places convenient to all working areas. Water or neutralizing agents shall be available where corrosive chemicals or other harmful substances are stored, handled, or used.

August 2018 Newsletter

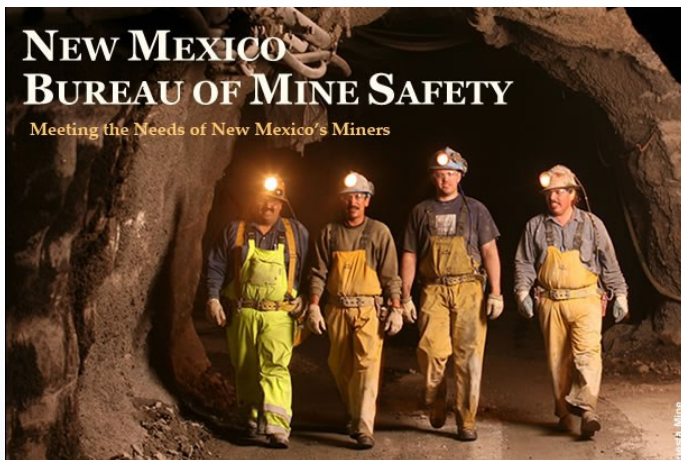
From Page 5

56/57.15001 First Aid Materials

This standard requires that adequate first-aid materials, including stretchers and blankets, shall be provided at places convenient to all working areas, and that water or neutralizing agents shall be available where corrosive chemicals or other harmful substances are stored, handled or used.

The purpose of this mandatory standard is to ensure that adequate first-aid materials, including eye wash solution, safety showers (not just "deluge" showers, but a constant warm water supply for long-term flushing) and other neutralizing agents are available to workers where corrosive chemicals or other harmful substances are stored, handled, or used. Neutralizing agents shall be readily available for first-aid treatment and cleanup of corrosive chemical spillage or leakage. Spill-control products are commercially available for all hazardous chemical substances.

These products both absorb and neutralize hazardous chemicals, thereby reducing the hazard to workers while containing the spilled chemicals.



Visit the New Mexico Bureau of Mine Safety Website

at

www.nmminesafety.com

or

www.bmi.state.nm.us

There you will find:

- Mine Emergency Information
- Training Schedules
- NM Safety Requirements
- Coal Mine Officials Certification Information,
- Contacts and much more..

Bureau of Mine Safety Calendar



August:

29-30 Mine Rescue comm. system training @ BMS office by invitation

September:

3 Labor Day-BMS office closed

5-7 NMMA Annual Convention and Expo-Ruidoso Convention Center.

October:

9-11 TRAM Conference, Beaver, WV

22-24 National Safety Congress, Houston, TX

22-24 Interstate Mining Compact Commission, midyear meeting, Biloxi, MS

30 Mining Safety Board, Carlsbad

November:

22-23 Thanksgiving—BMS office closed

Need New Miner Training, Annual Refresher Training, First Aid Training? The Bureau of Mine Safety is ready to assist. Part 46; Part 48-B

Call 575-835-5460



The Bureau of Mine Safety can now provide
First Aid & CPR
Certified by the National Safety Council

August 2018 Newsletter

MSHA will hold six public stakeholder meetings and one webinar on the Agency's Request for Information (RFI) addressing Safety Improvement Technologies for Mobile Equipment at Surface Mines, and for Belt Conveyors at Surface and Underground Mines. The meetings will be conducted in an informal manner. Presenters and attendees may provide written information to the court reporter for inclusion in the record. MSHA will make transcripts of the meetings available at <http://www.regulations.gov> and on MSHA's website at: <https://arlweb.msha.gov/currentcomments.asp>.

Date/time	Location	Contact No.
August 7, 2018, 9 a.m. Central Time	Sheraton Birmingham Hotel, 2101 Richard Arrington Jr. Blvd. N, Birmingham, Alabama 35203	205-324-5000
August 9, 2018, 9 a.m. Central Time	DoubleTree by Hilton Hotel, Dallas-Market Center, 2015 Market Center Blvd., Dallas, Texas 75207	214-741-7481
August 16, 2018, 11 a.m. Eastern Time	Webinar	202-693-9440
August 21, 2018, 9 a.m. Pacific Time	Renaissance Reno Downtown Hotel, One South Lake Street, Reno, Nevada 89501	775-682-3900
September 11, 2018, 9 a.m. Eastern Time	National Mine Health and Safety Academy, 1301 Airport Road, Beckley, West Virginia 25813 (Auditorium)	304-256-3100
September 20, 2018, 9 a.m. Eastern Time	Hilton Albany, 40 Lodge Street, Albany, New York 12207	518-462-6611
September 25, 2018, 9 a.m. Eastern Time	Mine Safety and Health Administration (Headquarters), 201 12th Street South, 4E401, Arlington, Virginia 22202	202-693-9440

Interested parties may attend these stakeholder meetings either in-person or Start Printed Page 35158 by participating by webinar (See table above).

To participate at the Webinar by Phone or WebEx:

By Phone—

- Dial the toll-free conference number (Verizon): 1-866-718-1874.
- Attendee access code: 242 716 6.

By WebEx—

To log into the Webinar, go to: <https://dol.webex.com>.

- Enter Meeting number: 642 399 450.

Meeting password: M!ne2018.

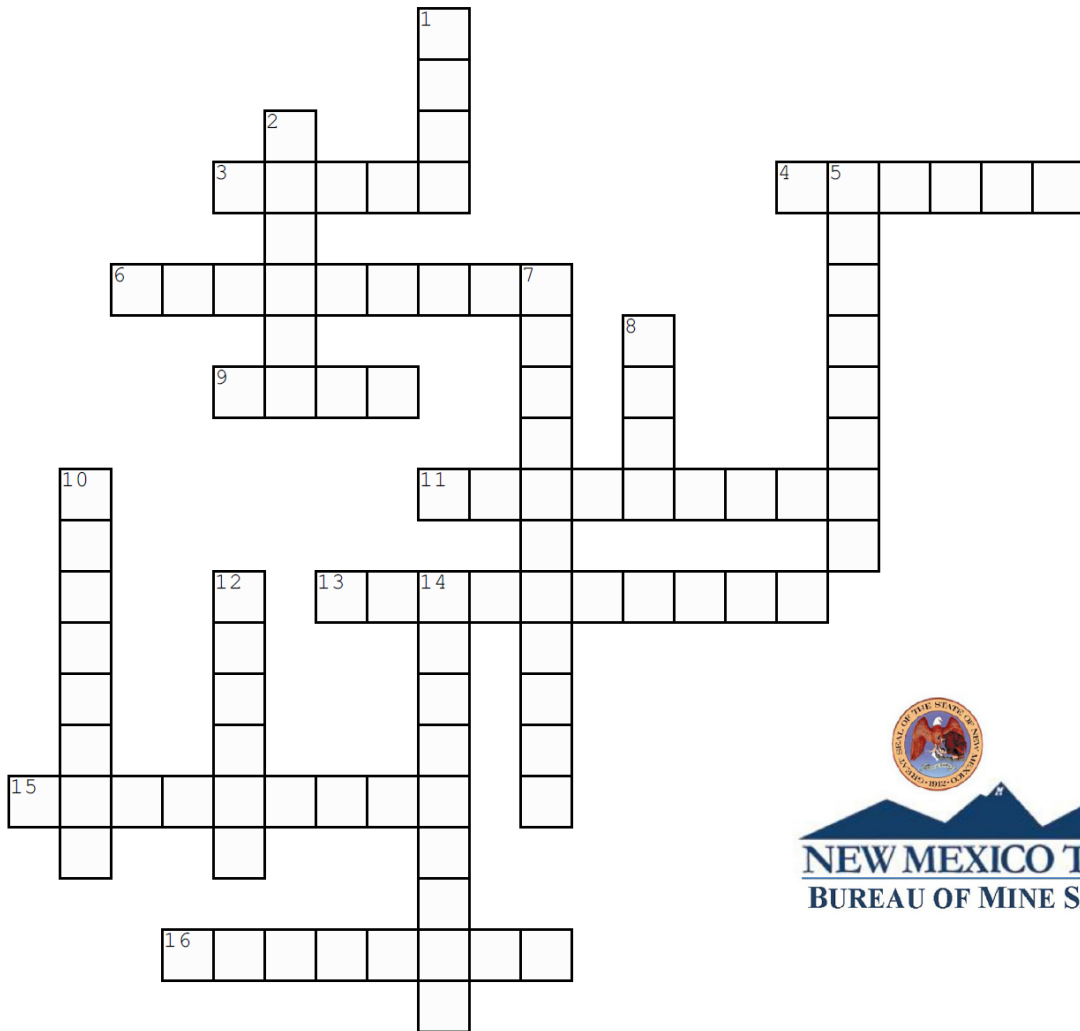
A. Stakeholder Meetings



August 2018 Newsletter

Ground Control

Complete the crossword below



Created with TheTeachersCorner.net [Crossword Puzzle Generator](http://CrosswordPuzzleGenerator.com)

Across

3. Terraced formation of a mining area minimizing the height of a highwall
4. The angle of _____ is the angle at which loose material is most stable
6. Evidence of separation of a highwall face as seen from above
9. Structure should be at least mid-axle height on equipment typically using the roadway
11. A pile of unconsolidated material, typically finished product
13. _____ of miners may result from unexpected movement of loose material
15. A pile of unprocessed material for feed into the process
16. Exposed vertical deposit of material to be mined

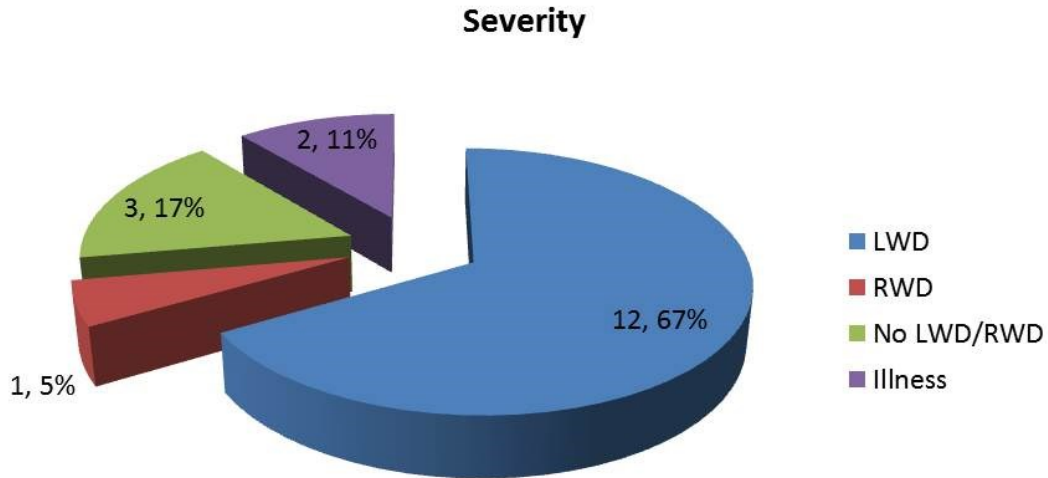
Down

1. When dumping over a highwall or pile, it is best to dump away from the edge and then _____ the material to the edge.
2. There may be a danger of entrapment of additional personnel during _____ of an entrapped miner
5. Ground conditions should be _____ from various perspectives to identify loose ground conditions
7. Entrapment by loose material may result in _____
8. Nearly vertical formation of natural deposits of sand and gravel being mined
10. A pile or bank is said to be _____ when material hangs over the area where material has been withdrawn
12. Loose material should be _____ from a safe location
14. A passage, walk, or way regularly used or designated for persons to go from one place to another

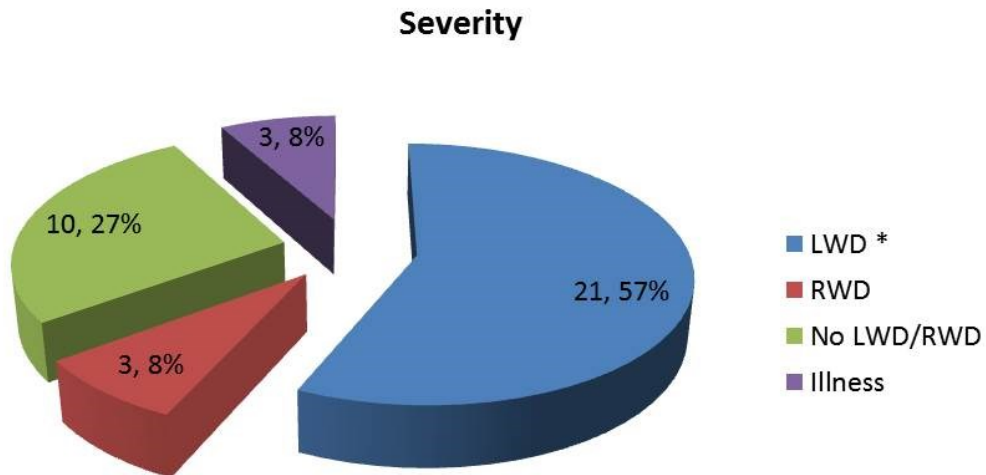
*The correct answers will be attached to the archived
March [Newsletter](http://mmminesafety.com) on the BMS website mmminesafety.com*

August 2018 Newsletter

NM 1Q 2018 MSHA Reportable (18)



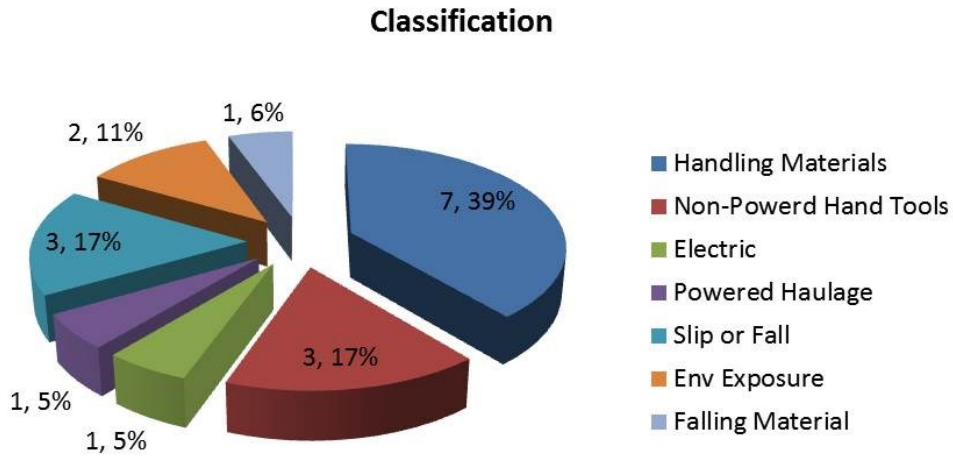
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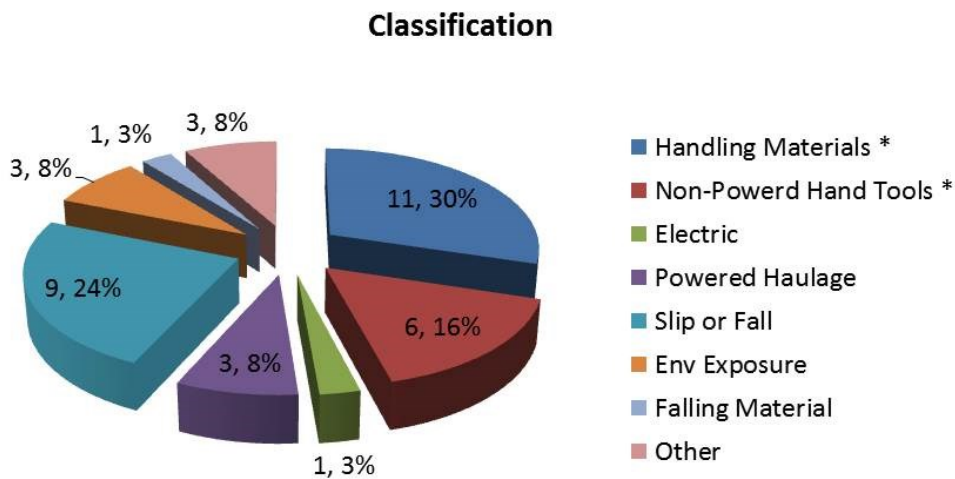
*two incidents charged to contractors

August 2018 Newsletter

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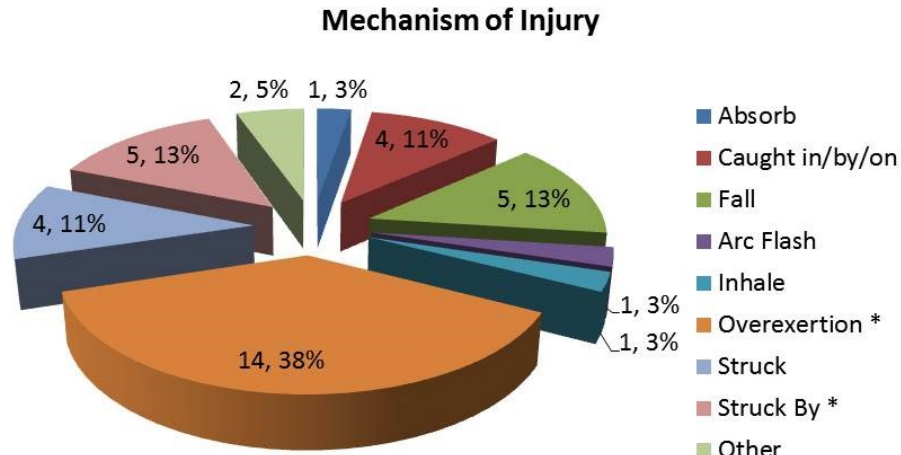
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*two incidents charged to contractors

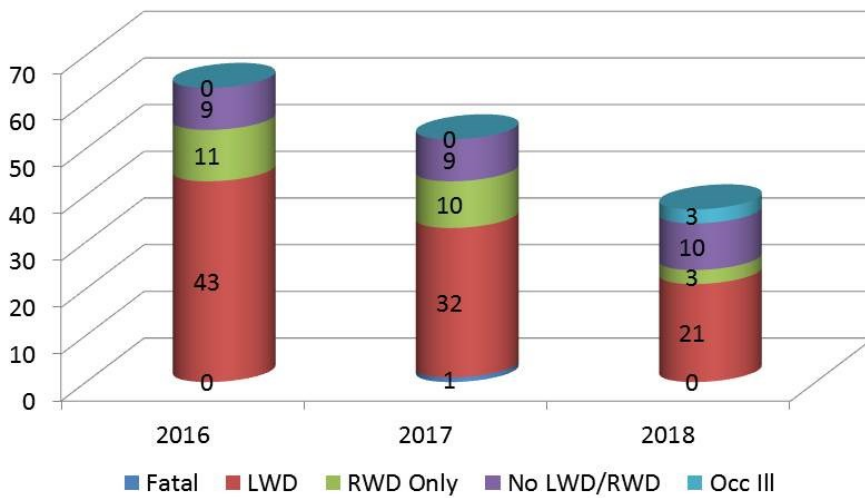
August 2018 Newsletter

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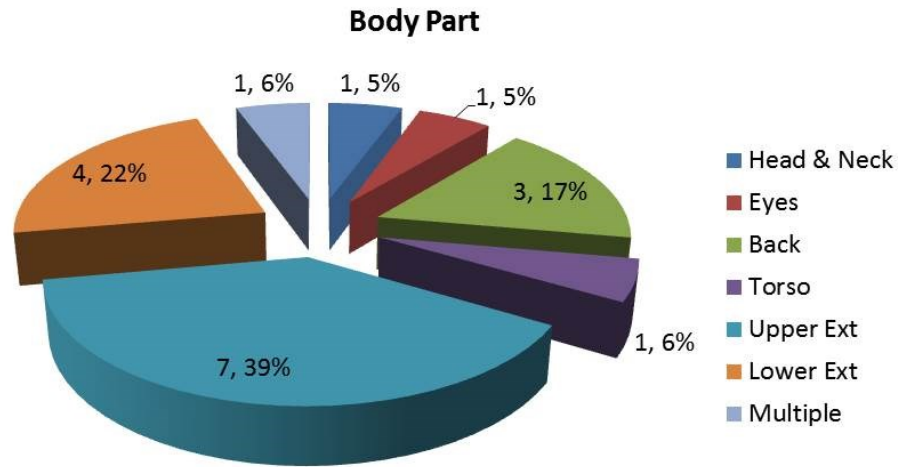
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NM Jan-June 2016-18 MSHA Reportable Injuries and Illnesses

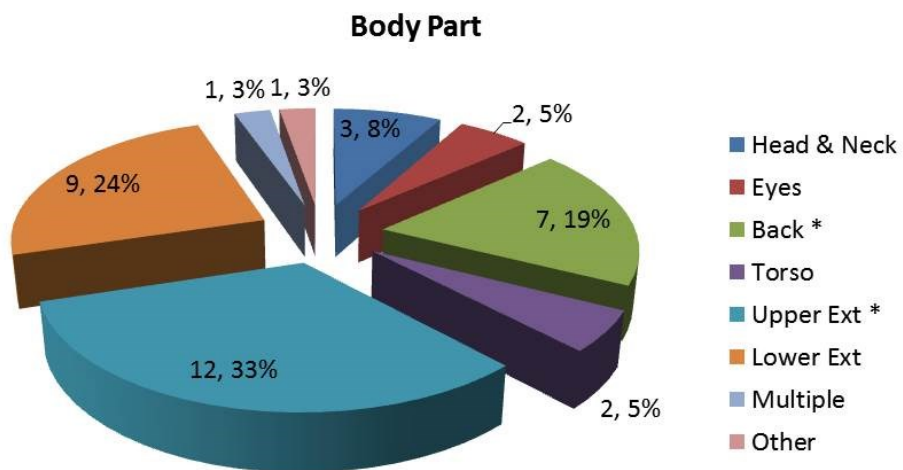


August 2018 Newsletter

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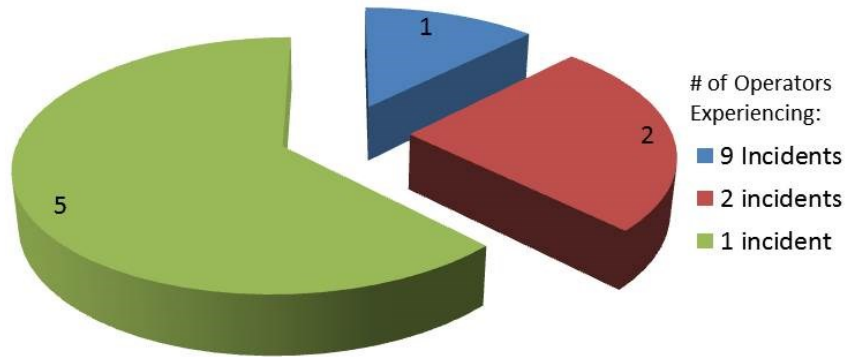


*two incidents charged to contractors

August 2018 Newsletter

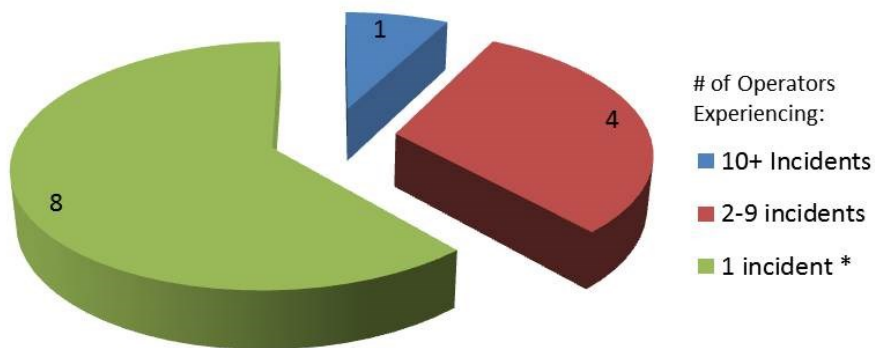
NM 1Q 2018 MSHA Reportable (18)

Distribution of incidents by Operator



NM Jan-June 2018 MSHA Reportable (37*)

Distribution of incidents by Operator



*two incidents charged to contractors