



**REVIEW OF FATAL ACCIDENTS IN  
METAL/NON-METAL MINING  
1995-1998**

**MINE SAFETY AND HEALTH ADMINISTRATION**

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**TABLE OF CONTENTS**

<b>ACRONYMS AND GLOSSARY</b> .....	<b>i</b>
<b>EXECUTIVE SUMMARY</b> .....	<b>ii</b>
<b>PURPOSE, BACKGROUND AND METHODOLOGY</b> .....	<b>1</b>
<b>FINDINGS</b> .....	<b>2</b>
A. Failure to Use Personal Protective Equipment is a Significant Factor in Metal/Non-Metal Fatalities .....	2
B. The Failure of Many Miners to Use Personal Protective Equipment is Related to Risk-Taking Behavior .....	3
C. More Diverse Training and Educational Approaches May Deter Risk-Taking Behavior and Increase Personal Protective Equipment Use Among Miners .....	4
D. MSHA's Ability to Control Risk-Taking Behavior Through Assessments Against Mine Operators is Limited .....	6
<b>RECOMMENDATIONS</b> .....	<b>10</b>
<b>APPENDICES</b>	
Appendix A - M/NM Mining Fatalities Pertaining to Personal Protective Equipment 1995-1998 .....	21
Appendix B - Studies on Seat Belt/Restraint System Use by Miners .....	33
Appendix C - Selected Bibliography/Research Sources .....	36
Appendix D - MSHA's Written Responses .....	39
(Dated January 27 and April 21, 2000)	

## **ACRONYMS AND GLOSSARY**

### **ACRONYMS**

CFR	-	Code of Federal Regulations
DOL	-	Department of Labor
GAO	-	U.S. General Accounting Office
IPA	-	Individual Personal Assessment
M/NM	-	Metal/Non-Metal Mining
MSHA	-	Mine Safety and Health Administration
NIOSH	-	National Institute for Occupational Safety and Health
OIG	-	Office of Inspector General, U.S. Department of Labor
OACE	-	Office of Analysis, Complaints and Evaluations
PPE	-	Personal Protective Equipment
ROPS	-	Rollover Protective Structures
WL	-	WestLaw

### **GLOSSARY**

**Fatality:** Death that occurs at a mine site which is not a result of natural causes. Not all fatalities counted by MSHA are necessarily those of miners. For example, non-miners killed while visiting or trespassing on mine property may be counted.

**Miner:** Person working at the mine site. We use the term “individual” and “rank-and-file” miner to denote miners without supervisory or corporate responsibilities.

**Mine Operator:** For purposes of this report, we are using the term “mine operator” to denote any corporate entity covered by the Mine Act, including contractors.

**Personal Protective Equipment:** For purposes of this report, we focused primarily on seat belts, safety belt/lines (also described as safety harness/lanyards), life jackets, and hard hats. However, personal protective equipment is anything that a worker can wear, carry, or use to protect against a hazard encountered while working.

## EXECUTIVE SUMMARY

This project was initiated to assist the Mine Safety and Health Administration (MSHA) in their analysis of factors which influence fatal accidents in the metal and non-metal (M/NM) sector of the mining industry. Fatal accidents in M/NM reached a ten year high in 1997. Our goal was not to revisit the various analyses already conducted by MSHA regarding M/NM fatalities. Instead, our review focused on factors contributing to fatal accidents not fully stressed by MSHA, or stressed fully in comparison with other variables.

Our methodology included an examination of MSHA investigative reports for all M/NM fatalities between 1995 and 1998. We also reviewed research regarding occupational and accidental deaths to explore the applicability of factors which may influence fatal accidents in the mining industry.

## RESULTS OF REVIEW

The review identified several areas for improvements which will allow MSHA to more effectively contend with miner risk-taking behavior in the area of personal protective equipment (PPE).

### **Finding A - The Failure to Use PPE is a Significant Factor in Metal/Non-Metal Fatalities**

Our review of the investigative reports for 212 M/NM fatalities between 1995 and 1998 indicates that, in a significant number of these fatalities, a failure to use PPE contributed to the fatal accident. Specifically, in at least 51 fatalities, miners did not utilize seatbelts, safety belts/lines, life jackets, hard hats, or other protective equipment. An additional 8 fatalities were PPE related, involving a more complex combination of miner behavior and PPE use. Three (3) other fatalities occurred in vehicles where MSHA currently has no regulatory authority to require seat belts. Additional studies conducted by MSHA and the Bureau of Mines complement this finding.

### **Finding B - The Failure of Many Miners to Use PPE is Related to Risk-Taking Behavior**

In a majority of the cases where miners did not use PPE, the mine operator had supplied the appropriate equipment, and often provided required MSHA training regarding its use. Even in those fatalities where information on PPE training was not discussed in the investigation report, it remains likely that most of these miners were aware of appropriate PPE use. Such fatalities correspond with the findings of researchers in the safety field that risk-taking behavior plays a significant role in workplace fatalities.

**Finding C - More Diverse Training and Educational Approaches May Deter Risk-Taking Behavior and Increase PPE Use Among Miners**

Safety training, including mandatory training conducted by mine operators, and MSHA's own use of educational safety sweeps, may not prevent risk-taking. However, MSHA can utilize the field of occupational psychology to develop training which directly addresses the causes of risk-taking behavior to promote PPE use.

**Finding D - MSHA's Ability to Control Risk-Taking Behavior Through Assessments Against Mine Operators is Limited**

Assessments pursued by MSHA against mine owners when their employees don't use PPE are generally too negligible to have much pro-active affect.

**RECOMMENDATIONS**

MSHA needs more educational, engineering, and enforcement tools to more effectively contend with miner risk-taking behavior in the area of PPE. Consequently, we recommend that MSHA:

1. Utilize certified occupational/safety psychologists to develop training and educational programs which specifically target risk-taking behavior and PPE use. This training should be developed as an ongoing process to provide consistent reinforcement to miners, and assimilated within MSHA's current training methods.
2. Review whether special and regular assessments for PPE violations can be pursued more effectively.
3. Pursue engineering controls, to combat the problem of miners not using PPE and enhance PPE effectiveness, whenever feasible. These should include regulatory proposals requiring mining vehicles to have additional passive safety equipment and enhanced restraint systems.
4. Over a five-year period, calendar years 2000 through 2004, MSHA should track and monitor the number of miners killed while not using PPE. If PPE related fatalities have not significantly declined, MSHA should examine other options to increase PPE use, such as individual assessments against any miners for PPE violations.

## **MSHA's RESPONSE AND OIG's CONCLUSIONS**

MSHA's response to the OIG's final draft report agrees that "PPE can be a major factor in the severity of an accident," and MSHA did not directly dispute the OIG's finding that behavioral factors play a role in PPE use by miners. However, MSHA also believes that the OIG report overemphasized the role of PPE use and risk-taking behavior as contributing factors in fatal accidents.

OIG report recommendations two and three are considered resolved, and MSHA has initiated corrective actions in these areas. OIG recommendations one and four remain unresolved. MSHA's complete response can be found in Appendix D.

## **PURPOSE, BACKGROUND AND METHODOLOGY**

### **PURPOSE**

This review was initiated to assist the Mine Safety and Health Administration (MSHA) in their analysis of factors which influence fatal accidents in the metal and nonmetal (M/NM) sector of the mining industry. MSHA's concerns regarding safety in the M/NM sector increased when on-the-job deaths in this sector reached a ten-year high in 1997. MSHA has reviewed a variety of factors, including mandatory safety training, miner age and experience, mine type, production volume, size of the M/NM inspectorate, job classification, geographic area, and day of the week as possible factors in fatality rates. Our goal was not to revisit the various analyses already conducted by MSHA regarding M/NM fatalities. Instead, we focused on factors contributing to fatal accidents which have not been stressed by MSHA, or stressed fully in relationship to other variables.

### **BACKGROUND**

MSHA enforces the Federal Mine Safety and Health Act of 1977 (Mine Act). MSHA carries out the mandates of the Mine Act at all mining and mineral processing operations in the United States regardless of size, number of employees, commodity mined, or method of extraction. MSHA has two primary divisions, "M/NM Mine Safety and Health" and "Coal Mine Safety and Health."<sup>1</sup> During our review period, M/NM mine operators were required to train their miners in accordance with 30 C.F.R. Part 48.

### **METHODOLOGY**

Our methodology included an examination of MSHA investigative reports for all M/NM fatalities between 1995 and 1998. An entrance conference was held with MSHA officials in December, 1998. Field work was conducted at MSHA's headquarters facility in Arlington, VA, the Dallas District Office, and the San Antonio field office, with additional interviews conducted via telephone with M/NM offices across the country. Exit conferences were conducted with MSHA on November 9, 1999, and April 5, 2000, to discuss our preliminary findings, and to solicit ideas and input regarding preliminary recommendations. MSHA submitted a formal response to our preliminary findings on January 27, 2000, and to the final draft of this report, on April 21, 2000.

We conducted our review in accordance with the *Quality Standards for Inspections* published by the President's Council on Integrity and Efficiency.

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<sup>1</sup> The Mine Act is codified at 30 U.S.C. 801 et seq. Prior to 1977, the metal and nonmetal mining industries and the coal mining industry were covered by separate occupational safety and health statutes.

## FINDINGS

### FINDING A - THE FAILURE TO USE PPE IS A SIGNIFICANT FACTOR IN METAL/NON-METAL FATALITIES

Our review of the investigative reports for the 212 M/NM fatalities between 1995 and 1998 indicates that, in a significant number of these fatalities, a failure to use basic personal protective equipment (PPE) contributed to the fatal accident. In at least 51 fatalities, miners did not utilize seatbelts, safety belts/lines, life jackets, hard hats, or other protective equipment, as stipulated directly in MSHA's investigative report.<sup>2</sup> An additional 8 fatalities were PPE related, involving a more complex combination of miner behavior and PPE use. Three (3) other fatalities occurred in vehicles where MSHA currently has no regulatory authority to require seat belts. A listing of all these fatalities is provided in Appendix A.

We recognize that the failure of miners to utilize PPE does not necessarily cause fatal accidents. For example, fatal accidents may be caused by mine operator negligence, physical error, unsafe behavior, and a wide range of other factors. However, whether the miner uses PPE can be a major factor in terms of the *accident* being *fatal*. This does not mean that PPE use can *guarantee* that a miner will not be killed or seriously injured while working in the mines - however PPE use can greatly decrease the likelihood of death or serious injury.

In particular, despite their ability to save lives and reduce the severity of injuries, the level of seat belt use by miners is low.<sup>3</sup> This is evidenced well beyond the fatalities examined during our review where seat belts were not used. Additional studies conducted by MSHA and the Bureau of Mines indicate that miner non-use of seat belts is a long-term, chronic problem.

For example, MSHA reviewed surface mining haulage accidents between 1987-1996 and found that seat belts were not used in 73 of 78 fatal accidents. For M/NM surface haulage fatalities, seat belts were not worn in 49 of 51 total deaths. Another MSHA's study of truck accidents between January 1990 and July of 1996 found that in 200 of 1,300 accidents miners failed to use seat belts. Overall, 640 of these 1,300 accidents resulted in traumatic injuries, including 139 fatalities. This study also concluded that, in 55 accidents involving trucks and berms, failure to use seat belts always resulted in

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<sup>2</sup> The number of fatalities where PPE was not utilized by the miner may be higher. Unfortunately, determining the exact number of miners killed while not using PPE was not possible. In some cases there were no witnesses to accidents involving vehicular accidents, falls, etc. In other cases MSHA investigators failed to address PPE use in relevant fatalities.

<sup>3</sup> Our discussions with MSHA officials indicate that mine vehicles can be modified to enhance restraint systems and control for their use. Passive safety controls may include vehicle sirens, buzzers, and lights which go off in the event that a miner removes his seat belt while the vehicle is in operation.



more serious injuries. A study conducted by the Bureau of Mines between 1989 and 1991 concluded that seat belts were worn in only 45% of mining haulage accidents. Finally, a 1987 MSHA study found that miners failed to use seat belts in 42% of M/NM haulage accidents. See Appendix B for references and more detailed discussion of these studies.

**FINDING B - THE FAILURE OF MANY MINERS TO USE PPE IS RELATED TO RISK-TAKING BEHAVIOR**

In a majority of the cases where miners did not use PPE, the mine operator had supplied the appropriate equipment, and often provided required MSHA training on its use. Even in those fatalities where information on PPE training was not discussed in the investigation report, it remains likely that most of these miners were aware of appropriate PPE use. For example, our interviews with M/NM inspectors, and our review of investigative reports, indicate that mine operators have postings available in vehicles and around the mines regarding PPE. Our finding that miners were killed in fatal accidents while not using available PPE corresponds with the findings of researchers in the safety field that individual *risk-taking behavior* plays a significant role in workplace fatalities. While perceptions of risk vary among individuals, there are phenomena isolated by safety researchers which illustrate why miners may be prone to risk-taking behavior.<sup>4</sup>

**Real Versus Perceived Risk**

Researchers contend that a worker's perception of risk is generally much lower than actual risk exposure. A vicious cycle occurs whereby every shift worked without an injury reinforces an "it is not going to happen to me" attitude which serves to further rationalize risk-taking behavior. Familiarity with a particularly dangerous job breeds complacency, and the more frequently a worker is exposed to a particularly dangerous work activity, the less risky it becomes in that worker's mind. The refusal of some M/NM miners to use PPE may attest to an imbalance between real and perceived risks in M/NM mining. For example, on May 5, 1997, a miner fell from his boat and drowned while draining a pond. This miner, who did not wear an available life jacket, could not swim, and had paralysis of his hip and leg.

**Risk Compensation**

Researchers also believe that workers are less likely to be threatened by risk-taking behavior that has benefits. For example, a miner may feel more comfortable not wearing a hard hat, or believe that he can work faster without taking the time to secure himself with a safety belt/line.

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Our focus for this report is risk-taking in the area of PPE. However, we identified other potential forms of risk-taking behavior which may have contributed to fatalities. These included miners using alcohol and/or drugs, operating vehicles recklessly and/or at excessive speeds, failing to de-energize or properly ground equipment, and being crushed or run over by unsecured mine equipment.

In light of the fact that M/NM miners forgo the use of PPE, it appears that many M/NM miners are tolerating unnecessary risk as part of their job.<sup>5</sup>

### **The Myth of Controllable Hazards**

Researchers are critical when workplace hazards are portrayed as inherently controllable by employers or government regulators through engineering controls alone, and they contend that this compounds the problem of reduced risk perception. For example, in our review of MSHA accident reports, we found that structures designed to prevent mine vehicles from going over the edges of pits and roads were easily run through by mine vehicles. In addition, vehicle rollover protective structures (ROPS) can be useless in roll-overs if seat belts are not also used. Yet, miners operating vehicles may feel "protected" by berms, guardrails, ROPS, etc.- gaining a false sense of security when in fact they are at risk. In contrast to over-stressing accident controllability, a current tenet among safety researchers is that, although accidents can be reduced, they happen, and employees must be motivated to accept and prepare for this reality through the use of PPE.

### **Risk-Taking and "Near Hits"**

Research also shows that some employees are only motivated to stop engaging in risk-taking behavior after they experience what researchers term a "near hit" – an experience where an employee narrowly avoids an injury or accident. H.W. Heinrich's "*Law of Safety*" states that there are numerous risky acts for every near hit, and many more near hits than lost-time injuries.<sup>6</sup>

Ultimately, timing and luck serve as the only difference between a near hit and a serious or fatal injury. Of course, these potentially life-threatening near hit events are the worst possible form of safety education for employees. Worse still, even employees who experience dramatic near hits may still engage in risky behavior. For example, on September 30, 1997 a miner not wearing his seat belt was ejected from the vehicle and crushed underneath it after a roll-over. Ironically, the miner had rolled this vehicle on a previous shift, but was wearing a seat belt and was not injured.

<p><b>FINDING C - MORE DIVERSE TRAINING AND EDUCATIONAL APPROACHES MAY DETER RISK-TAKING BEHAVIOR AND INCREASE PPE USE AMONG MINERS</b></p>
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Safety training that does not effectively address risk-taking behavior by miners may have limited results. For example, as we have seen in our review, miners *trained* to use PPE were not necessarily *motivated* to use it. An area of agreement between MSHA and the OIG during our review is that

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<sup>5</sup> Risk-taking in mining is not limited to the United States. A survey conducted by the Australian Government indicated that one-third of Western Australia's underground miners and mine foremen consciously took risks or behaved unsafely. Reasons for risk-taking behavior were time, effort, and monetary savings. See WL (WestLaw) 21947344.

<sup>6</sup> Heinrich's research concluded that 88% of industrial accidents were caused primarily by unsafe acts, as opposed to unsafe conditions.

mandatory training conducted by mine operators (30 C.F.R. Part 46 and Part 48) may not deter risk-taking behavior.<sup>7</sup> As we found in our review, miners killed while not using PPE worked for mines subject to mandatory safety training, or for mines “exempt” from direct training enforcement by MSHA, who nonetheless had required training/polices in place.

Training conducted by MSHA has also been limited in its ability to control risk-taking. For example, since 1995, MSHA has periodically engaged in massive educational safety sweeps at M/NM mines, using “talking points” to stress the importance of using PPE. However, even such special efforts were not successful in ensuring PPE use. As shown in Appendix A, failure to utilize PPE contributed to a significant number of miner fatalities in 1996, 1997, and 1998. A tragic example of this problem occurred during a MSHA's nationwide sweep of M/NM mines, when a truck driver was killed only one day after attending an MSHA presentation dealing with, among other things, using seat belts. The driver ignored MSHA's admonitions to wear a seat belt and was thrown through the windshield when his truck struck a berm on a haulage road.<sup>8</sup>

We are not contending that either mandatory or special training is unimportant to the health and safety of miners. Indeed, MSHA should be commended for its work in the development of Part 46 training regulations and special training efforts in the field. However, miner behavior in the area of risk-taking and PPE should not necessarily be expected to improve dramatically through mandatory or MSHA training alone, in their current forms.

### **Occupational/Safety Psychologists Target Risk-Taking Behavior**

The field of occupational or “safety” psychology specifically addresses psychological factors, such as risk-taking, which negatively influence safety in the workplace. Training conducted by safety psychologists is intended to go beyond the basic “do's and don'ts” of safety training to target the “it can't happen to me” attitude which is prevalent among workers who don't use PPE.<sup>9</sup> There are various cognitive and behavioral strategies used by psychologists that can motivate miners to use PPE. The reference material listed in Appendix B provides an overview of these methods, in addition to detailed information on risk-taking behavior and workplace accidents.

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7 MSHA expressed this opinion in its January 27, 2000 response to our preliminary findings. Mandatory training covers a wide variety of topics, and does not have a specific focus on risk-taking behavior.

8 See WL17509666, Rock Products Magazine, Demand Safety, March 30, 1998.

9 Persuasive safety training enhances perceptions of safety threats, while reinforcing the efficacy of responses to threats. In terms of miners and PPE, training would entail, 1) making miners feel more threatened if they don't use PPE, and 2) educating miners regarding the importance of PPE, including refutations of myths which might discourage PPE use. Our review indicates that these myths may include beliefs that miners are somehow *safer* in an accident when a seat belt is not used, or that they are safer jumping from an out of control mine vehicle, rather than remaining buckled up.

**FINDING D - MSHA's ABILITY TO CONTROL RISK-TAKING  
BEHAVIOR THROUGH ASSESSMENTS  
AGAINST MINE OPERATORS IS LIMITED**

MSHA can propose assessments from \$50 to \$55,000 against mine operators for PPE violations. In theory, citing and fining mine operators should have a strong trickle down effect because it would be in the mine operator's best economic interests to internally police PPE use among its miners. However, MSHA's assessments for PPE violations appear too low to seriously motivate mine operators. Specifically, our review of paid regular and single penalty assessments for PPE violations indicates that paid assessments were generally not far from the \$50 minimum.<sup>10</sup>

- < For 1,182 paid assessments of violations of 30 CFR. 56.14130(g) where seat belts were not used by miners, the average regular assessment paid was **\$179**. Virtually all of these were considered "significant and substantial" (S&S) violations where MSHA determined a reasonable likelihood of serious injury. 401 single penalty assessments averaged \$50.
- < For 497 paid assessments of S&S violations at 30 CFR. 56.14131(a) involving seat belts use in haulage trucks, the average regular assessment paid was **\$176**. 124 single penalty assessments averaged \$50.
- < For 1,060 paid assessments of S&S violations at 30 CFR. 56.15005, involving failure to use safety belts and lines, the average regular assessment paid was **\$223**. 62 single penalty assessments averaged \$50.
- < For 118 assessments of S&S violations at 30 CFR. 56.15020, where life jackets were provided but not used by miners, the average regular assessment paid was **\$202**. The 18 single penalty assessments averaged \$50.

**Special Assessments**

After miners are killed or injured while not using PPE, MSHA usually proposes steep special assessments against the mine operator - up to the \$55,000 maximum. After paying a large fine, a mine operator probably will be more motivated to ensure that his employees use PPE. However, the limitation of this type of assessment is that it is reactive, serving to motivate only after death or injury has occurred. Although MSHA can also use its special assessment authority in cases other than when a fatality or injury has already

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10 Data provided by MSHA for the period between January 1, 1995 and June 24, 1999. Regular assessment amounts *proposed* by MSHA were consistent with the assessments *paid* by mine operators.

occurred, our review indicates that such special assessments are relatively rare.<sup>11</sup> A further limitation of special assessments is that they are significantly reduced or dismissed when contested by mine operators if mine operator negligence is determined low by Administrative Law Judges or the Federal Mine Safety and Health Review Commission.

In either regular or special assessments for PPE violations, the mine operator's level of negligence is a major component in terms of how great an assessment MSHA can viably pursue. Negligence can be low, for example, if a determination is made in a contested case that the failure to utilize safety equipment was fundamentally more a matter of miner choice than mine operator negligence. Negligence will normally be lower when the mine operator has 1) provided/maintained PPE, and, 2) trained miners on PPE, or otherwise encouraged its use. In the PPE related fatalities we examined, the vast majority of mine operators provided PPE, and many conducted appropriate training.<sup>12</sup>

### **“Strict Liability” Limits MSHA’s Ability To Target Individual Miner Behavior in the Area of PPE Enforcement**

With the exception of violations involving smoking, mine operators and their agents are held strictly liable for violations of the Mine Act. Such strict liability is essential for the enforcement of the vast majority of safety and health requirements of the Mine Act. For example, a mine operator's responsibility to control respirable pathogens, or ensure proper methane ventilation, is logical since individual miners cannot be expected to have either the authority or the means to implement all aspects of compliance. However, strict liability does not necessarily serve the best interests of miners when the safety issue is PPE. For example, if an individual miner chooses not to wear a seat belt provided by the mine operator, it is the mine operator, not the miner, who is cited and fined by MSHA. Strict liability applies to all PPE equipment, and is in effect even when the mine operator has 1) provided and maintained PPE equipment; and 2) trained miners on PPE, and/or encouraged its use.

### **Enhanced Assessment Authority Could Curb Miner Risk-Taking Behavior in the Area of Personal Protective Equipment**

As demonstrated by the high number of fatalities where failure to use PPE is a contributing factor, and because assessments against mine operators are generally too minimal to ensure that miners use PPE,

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11 For example, of 1,673 paid assessments made for seat belt violation 56.14130(g), only 81 special assessments were collected in situations other than an injuries/fatalities.

12 A “rank-and-file” non-supervisory miner’s negligence cannot be directly imputed to his employer for purposes of penalty assessment. See *Western Fuels-Utah, Inc.*, FMSHRC 256, 260-261 (March 1988); *Southern Ohio Coal Co.*, 4 FMSHRC 1459, 1464 (August 1982). For a case involving a fatality during our review period that demonstrates the mitigating effects of miner negligence, see *Jobe Concrete Products Inc.*, 21 FMSHRC 1143 (October 1999).

we believe that MSHA should study whether its civil penalty assessment authority be extended to include individual, “rank-and-file” miners when they are culpable for

PPE violations.<sup>13</sup> Although this may require a statutory change to the Mine Act, we believe it could improve PPE use among miners.

### **Precedents where Individuals are Liable for Unsafe Acts in Mining**

Pursuant to Section 110(g) of the Mine Act, any miner can be personally fined \$275 when they engage in smoking activity or possess smoking related materials at the mine site. MSHA has conducted special mine “sweeps” to enhance its enforcement efforts in this area. Mine operators are held responsible for educating and monitoring their employees in regard to smoking materials, and are also held liable for civil penalties for smoking related violations. Both MSHA and operator efforts are designed to ensure that miners neither purposefully or inadvertently carry smoking materials into the mines - and these efforts have been very successful. In the forty years prior to enactment of the Mine Act, 843 miners were killed in smoking related explosions. In contrast, no more than 39 miners have been killed in smoking related explosions since the passage of the Mine Act in 1977, and none since 1994.

Any miner who knowingly violates any mandatory West Virginia safety or health standard is liable for an Individual Personal Assessment (IPA) of up to \$250 per violation. The ability of West Virginia, a state with strong traditional ties to organized labor, to institute and retain use of its expansive IPA program may illustrate that obtaining limited individual assessment authority for PPE violations is achievable.<sup>14</sup>

### **Additional Support: PPE Laws Which Hold the Individual Liable are Successful**

One successful example of government holding individuals personally liable when they engage in risk-taking behavior that jeopardizes their own safety is in the area of seat belts. Every state but New Hampshire has mandatory seat belt laws for adults. Sixteen states have “primary” enforcement laws whereby law enforcement personnel can ticket motorists solely because they are not wearing seat belts, and data from the Center for Disease Control and Prevention shows that these primary

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<sup>13</sup> MSHA can already assess individual civil penalties against corporate directors, officers, or mine agents for knowing and willful violations of the Mine Act. This includes individuals such as mine foremen who work side by side with regular rank-and-file miners. These men are killed and injured every year while mining, and are counted in MSHA’s annual fatality statistics.

<sup>14</sup> See <http://www.state.wv.us/mhst/News.htm>. Our review did not encompass a review of the effectiveness of IPA’s, or the level of enforcement activity on the part of West Virginia’s Office of Miners’ Health, Safety and Training in the area of IPA’s. Because West Virginia miners are liable for all health and safety violations, not PPE violations alone, states with primary seat belt laws may be better models regarding the effectiveness of individual sanctions and increased PPE use.

enforcement laws are extremely effective, decreasing motor-vehicle-related deaths by 13% to 46%.<sup>15</sup> Other states have “secondary” enforcement laws which require that motorists be pulled over for some other infraction before they can be ticketed for seat belt violations.

The efforts by the states to increase seat belt use have been highly successful. This increased use has resulted from a combination of government initiatives targeting both education and enforcement (fines and points). However, traffic safety and law enforcement officials credit the threat of sanctions as integral to the success of laws designed to increase seat belt use.

Critics of mandatory seat belt laws contend that threats of penalties against motorists are not effective behavioral motivators because the enforcement of seat belt laws is rare. However, this may largely be a matter of how tough each state chooses to be in their enforcement efforts. North Dakota, a state with a weak secondary seat belt law and lax enforcement, has only a 43% rate of use for seat belts.<sup>16</sup> In contrast, California’s strict enforcement approach is credited with making it the national leader in seat belt use at 87%.<sup>17</sup>

We believe that, if authorized, MSHA could effectively devise a strategy to properly enforce PPE related assessment authority against individual miners. Such enforcement efforts would not entail a shifting of responsibility from mine operators to individual miners. MSHA would continue to be responsible for proposing assessments for PPE violations against negligent mine operators. Rather, enhanced PPE assessment authority would reflect shared responsibility between individual miners and mine operators - a real world acknowledgment that individual miners play a prominent role in PPE use.

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15 See WL 21068561, Journal of the American Medical Association, *Motor-Vehicle Safety: A 20<sup>th</sup> Century Public Health Achievement*, June 1999.

16 See, e.g., General Accounting Office, *Motor Vehicle Safety: Comprehensive State Programs Offer Best Opportunity for Increasing Use of Safety Belts* (GAO/RCED-96-24, January, 1996); Los Angeles Times, “Seat Belts Often Take a Back Seat,” December 4, 1997;

17 Ibid.

## **RECOMMENDATIONS**

Given that mining is such a dangerous occupation, we would expect that miners would unfailingly use the seat belts, safety lines, life jackets, and hard hats which can save their lives. However, this is not the case. Our review confirms that miners die in significant numbers when they forgo PPE use. As we have demonstrated, MSHA's ability to motivate miners to avoid such risk-taking through either training or assessments is limited, and it is unclear as to whether all engineering advances in the area of passive safety have been pursued by MSHA.

To increase PPE use by miners, we recommend that MSHA implement the following educational, engineering, and enforcement solutions. None of these recommendations should be viewed in isolation; rather, they should be pursued as part of an integrated strategy to reduce fatalities and injuries by increasing PPE use.

### **RECOMMENDATION #1**

MSHA should utilize certified occupational/safety psychologists to develop training and educational programs which specifically target risk-taking behavior and PPE use. This training should be developed as an ongoing process to provide consistent reinforcement to miners, and assimilated within MSHA's current training methods.

#### **MSHA's Response**

*Behavioral psychologists have, in the recent past, presented to the safety and health community some insight into accident causation. When their analysis looks at the complete accident cause, including the system failures and individuals' behavior (both management and labor) constructively, then their efforts have been of some help.*

*However, the OIG has presented no evidence that establishes that training and educational programs developed by occupational or safety psychologists are more effective than programs developed by other professionals in deterring risk-taking behavior or encouraging PPE use-especially when, as in this matter, the efforts focus only on the behavior of one aspect of presenting the review.*

*Representatives from MSHA's Directorate of Educational Policy and Development recently met to discuss addressing miner training needs with representatives from the National Institute for Occupational Safety and Health (NIOSH). We are exploring with NIOSH ways in which we might use occupational psychologists in developing training programs designed to reduce risk-taking behavior and encourage the use of PPE on the part of both management as well as labor. The report's narrow focus on employee behavior fails to recognize the risk-taking behavior of top and middle management, and does not address one of the main requirements of*



*effective training programs: a steadfast, unyielding commitment to safety at all levels from top management on down.*

*There is no consensus among professionals in the field of occupational psychology on the type of training best suited to altering risk-taking behavior. It appears likely that significant research remains to be done in this area before effective training programs will be developed. The professional safety and health community views with skepticism the use of behavioral controls. If it is used in a broad-based context for both management and labor it has limited usefulness. If, however, it is used as this report reasons, it could well result in a prejudicial outcome. The effect would be to blame the victim, a concept which should be rejected in the final years of the 20th century.*

*The OIG should be aware that MSHA has no authority to require mine operators to use any training programs that MSHA may develop in response to this recommendation. Although mine operators are required by MSHA regulations to provide specific health and safety training to miners, there is nothing in either the Mine Act or the regulations which mandates that mine operators use MSHA-developed training programs.*

*Mine operators are free to develop their own training in-house or arrange with State agencies or private contractors for required miner training to be provided. In either case, there must be commitment from company management for any of this training to be effective. This would also hold true for any behavior-based training MSHA develops.*

### **OIG's Conclusion**

We agree with MSHA's concerns that effective training programs need to address safety at all levels, and that any analysis needs to look at the complete accident cause. It is precisely for those reasons that, as part of its overall training programs, MSHA needs to incorporate the cognitive or behavioral methods developed by occupational/safety psychologists which stress to employees why their behavior is risky and the potential results of unsafe behavior for the purposes of promoting culture change.

While MSHA's meeting with NIOSH to explore ways to use occupational psychologists in developing programs designed to reduce risk-taking behavior is a good first step, we believe that MSHA can augment its work with NIOSH by utilizing the cognitive behavior approaches that teach employees to understand why their attitudes, values, beliefs and thought processes affect safety on and off the job.

**This recommendation is considered unresolved. To resolve this recommendation, please forward a copy of MSHA's specific action plan within 60 days of issuance of this final report.**

### **RECOMMENDATION #2**

MSHA should review whether special and regular assessments for PPE violations can be pursued more effectively, particularly in situations where a mine operator has demonstrated past PPE compliance problems.

### **MSHA's Response**

*MSHA utilizes enhanced assessments for penalties for violations of some health and safety standards. Under our assessments regulations specified in 30 CFR part 100 and the Mine Act, we can propose an assessment of up to \$55,000 for any single violation, depending on the facts of the violation and the size of the operation. Our policy and §100.5(a)(8) provide that violations that involve "unique aggravating circumstances" may be considered for special assessment. A penalty that results from a special assessment is almost always higher than the penalty generated under the regular assessments formula (thousands of dollars rather than hundreds of dollars).*

*The Administrator may designate violations of certain safety or health standards for consideration for special assessment. We are in the process of developing a memorandum that directs both Metal and Nonmetal and Coal District Managers to review for special assessments all violations issued for failure to use personal protective equipment.*

### **OIG's Conclusion**

**In a memorandum dated April 20, 2000, MSHA directed both Metal and Nonmetal, and Coal District Managers to review for special assessments all violations issued for failure to use personal protective equipment. This recommendation is considered resolved and closed**

### **RECOMMENDATION #3**

MSHA should pursue engineering controls to combat the problem of miners not using PPE and enhance PPE effectiveness, whenever feasible. These should include regulatory proposals requiring mining vehicles to have additional passive safety equipment, including, but not necessarily limited to:

- a. Warning devices, e.g., lights, buzzers and/or sirens, which would serve both to remind the occupants, as well as alert an observer, if a vehicle occupant removes a seat belt/restraint system while the vehicle's engine is running.
- b. Requirements for all mine vehicles to have restraint systems for the lower torso (seat belts) for both equipment operators and passengers, whether or not the vehicle has Roll Over Protective Structures (ROPS).
- c. Requirements that all newly manufactured mine vehicles have both lower torso (e.g. lap

belt) and upper torso restraint systems (e.g., harnesses or equivalent).

### **MSHA's Response**

*MSHA began its review of seat belt use and warning lights for surface haulage vehicles as a result of initial analysis of these types of accidents in 1994. As a result of these studies, a regulatory plan was published in the Federal Register in 1995.*

*MSHA published an Advance Notice of Proposed Rulemaking in the Federal Register on July 30, 1998, concerning safety standards for surface haulage equipment. MSHA examined approximately 8,000 surface accidents (from 1987 to 1996) involving powered haulage equipment which resulted in either fatalities or lost work days. During that time, 120 miners were killed and 1,377 were injured due to three causes or contributing factors: unused or inadequate occupant restraint systems on the equipment; blind areas on self-propelled mobile equipment; and lack of adequate illumination. MSHA is in the process of developing a proposed rule that would include requirements for surface haulage equipment in three specific areas: illumination; restraint systems; and blind areas. MSHA anticipates publication of this proposal in July.*

*MSHA currently intends to propose requirements that would require a "seat belt in use" light outside the equipment cab to indicate whether an equipment operator is wearing the seat belt. It has been our experience that positive reinforcement devices such as the "seat belt in use" light are more likely to be accepted by the employees than negative reinforcement devices such as a bell or siren. Additionally, for equipment having an obstructed view to the rear, if the mobile equipment uses a discriminating warning device to detect objects or persons at the rear of the equipment, we propose to require audible or visual alarms inside the cab to alert the vehicle operator of persons or objects detected in the sensing area. We are reserving audible alarms for this unique purpose.*

*The current draft of the proposed rule would require that most existing equipment (both ROPS and non-ROPS equipment) be equipped with two-point seat belts. Although we considered requiring four-point seat belts on all new equipment, we concluded that four-point seat belts impose limitations on upper body mobility that could create safety hazards for operators of some types of equipment. For example, some equipment operators pivot to see through side windows or turn around to see through back windows rather than use mirrors while backing equipment. If too constrained by four-point seat belts to pivot or turn, equipment operators might miss side or back views essential to steer equipment or attachments clear of nearby people, equipment, and other objects.*

*Obviously, we cannot guarantee which requirements will ultimately be incorporated into the final rule. The public will have the opportunity to comment on the proposed rule once it is*

*published in the Federal Register, and we will carefully consider all of the comments we receive in developing the final rule.*

### **OIG's Conclusion**

The OIG supports the measures that MSHA is pursuing. We also believe that MSHA should continue to evaluate all available engineering control options. For example, an internal buzzer which monitors seat belt use need not be so loud, nor the same type of sound, that it interferes with other warning devices.

**This recommendation is considered resolved and will be closed pending receipt of a copy of the final rule.**

### **RECOMMENDATION #4A**

Over a five-year period, calendar years 2000 through 2004, MSHA should track and monitor the number of miners killed while not using PPE, to evaluate the effectiveness of recommendations 1, 2, and 3, or any other measures deemed appropriate by MSHA to increase PPE use by miners. However, after this period, if PPE related fatalities have not significantly declined, MSHA should examine other options, such as individual assessments against any miner for PPE violations, to increase PPE use.

### **MSHA's Response**

*We strongly disagree with the OIG's recommendation to leave open the option of assessing monetary penalties against miners who violate PPE regulations. With this recommendation, the OIG disregards the fundamental principal established in the Occupational Safety and Health Act of 1970 and the Federal Mine Safety and Health Act of 1977. These laws recognize that employers, not workers, have control over their workplace and, therefore, have primary responsibility for ensuring that workplaces are safe and healthful. We urge the OIG to delete this recommendation from the final report.*

### **OIG's Conclusion**

We agree with MSHA that employers have primary responsibility for ensuring that workplaces are safe and healthful. However, as we previously stated, individual miners do have significant control over PPE use. Using seat belts as an example, it is obvious that when a miner gets into his/her truck, the miner has direct control as to whether or not the seat belt is used. Mine operators should aggressively monitor the seat belt use of their miners, however, mine operator officials: (1) may not always be vigilant in monitoring whether miners use their seat belts, and (2) cannot be everywhere at the mine site. This was obvious in both our review of MSHA fatality

reports, and in our review of MSHA's own data on fatalities where seat belts were not used. MSHA's data shows that, between 1987 and 1996, in 78 fatal surface haulage accidents, 73 of the miners killed were not wearing their seat belts. Therefore, while we agree that ideally, operators would continually monitor and enforce seat belt use by their employees - in reality, in far too many cases, this simply has not occurred.

In 1977 when MSHA began enforcing the Mine Act, not a single U.S. state had either a primary or secondary seat belt law. Since that time, beginning around 1984, state governments began pursuing seat belt laws. These seat belt laws were highly controversial, and fraught with ideological issues (infringement on civil liberties, big government interference, etc.). Gradually, however, various state legislatures made pragmatic decisions that seat belts laws would save lives. From that beginning, states began moving from weaker secondary to tougher primary seat belt laws. This safety evolution spawned laws mandating the use of motorcycle helmets, bicycle helmets, and child safety seats to protect individuals from their own unsafe behavior. Studies have established, empirically, that these laws save lives and prevent serious injuries. It is not expected that these states will turn back the clock on these laws. In fact, since we began our first draft of this report, three additional states have implemented primary seat belt laws.

We see no reason why MSHA should not view this evolution in safety as potentially having value and applicability to the Mine Act. It is an issue that, at a minimum, should be given very serious consideration. Our recommendation is limited only to MSHA *examining*, over a five-year period, whether individual assessments are a needed option to increase PPE use among miners.

**This recommendation is considered unresolved.**

#### **RECOMMENDATION #4B**

For tracking purposes, MSHA must ensure that every fatal accident investigation report address miner use of PPE in all applicable fatalities (vehicular accidents, falls, drownings, head injuries, etc.). For monitoring purposes, MSHA should establish a separate section on its Web page that lists all fatalities where failure to use PPE was a contributing factor. In addition to tracking fatalities, an additional method of measuring the level of PPE use among miners could be to track serious injuries each year where failure to use PPE was a factor.

#### **MSHA's Response**

*MSHA's accident investigators examine the use of PPE and have done so for many years. MSHA will continue to examine this and all relevant factors in its investigations and include this information in its written reports and educational materials. On an ongoing basis, MSHA closely examines its full range of data to better focus its enforcement, educational and regulatory programs. This includes tracking a myriad of factors that relate to, contribute to, or*

*are somehow related to injuries, illnesses and fatalities in mining.*

### **OIG's Conclusion**

In the majority of the investigative reports we examined, MSHA investigators appropriately addressed whether PPE was utilized in applicable fatalities (vehicular accidents, falls, drownings, etc.) However, we found a number of pertinent fatalities where MSHA investigators failed to discuss PPE use. MSHA should notify its accident investigators of the need to ensure that PPE use is addressed in every accident investigation report. Given the significant number of fatalities which occur where non-use of PPE is a factor, we also believe that MSHA should devote a portion of its extensive Web site to track fatalities where non-use of PPE was a factor. This would elevate PPE as a *distinct* category within the myriad of other items already on the MSHA Web site, and could further highlight to the mining community the importance of PPE use.

**This recommendation is considered unresolved. To resolve this recommendation, please forward an action plan within 60 days of issuance of this final report.**

### **ADDITIONAL AGENCY COMMENTS**

#### **MSHA's Comments on the Report Methodology**

*The stated purpose of the OIG report is "...to assist MSHA in their analysis of factors which influence fatal accidents in the metal and nonmetal sector of the mining industry." Noting that MSHA analyzes many factors in order to determine the causes of accidents, the OIG decided to instead focus "...on factors contributing to fatal accidents not fully stressed by MSHA, or stressed fully in relationship to other variables."*

*MSHA questions the merit of this methodological technique. By design, the analysis overemphasizes one factor, to the exclusion of other more significant factors.*

*The methodology section of the report also states "A review of research regarding occupational and accidental deaths was also conducted to explore the applicability of factors which may influence fatal accidents in the mining industry." The report authors include a bibliographical note which indicates the narrow scope of the research: "...our bibliography provides an overview of the issues surrounding cognitive/behavioral safety training, in addition to detailed information on risk-taking behavior and workplace accidents."*

*The report's authors did not consider the broader body of occupational safety and health research and analysis which has developed over the past 50 years. A fundamental and well-accepted principle of occupational safety and health is the 3-tiered hierarchy of accident prevention and*

*control. The hierarchy is engineering controls, administrative controls, and personal protective equipment (PPE), with engineering controls recognized as the first line of defense to prevent*

*workplace injuries and illnesses. This hierarchy has been adopted by MSHA, OSHA and other occupational safety and health agencies in the United States and around the world.*

*In addition, the report authors appear to neglect or ignore the studies of inadequate corporate safety and health programs, and the successes and failures of various corporate approaches.*

*This single-minded approach is overly simplistic and, consequently, flawed. The analysis focuses on only one part of the complex process of worker safety and accident prevention. By focusing on personal protective equipment and "risk-taking" behavior, there is an implication that the miner is mostly to blame for fatal accidents. In reality, most failures that result in mining fatalities are system failures. They may be failures in the haulage systems, the communications systems, etc. The failures typically occur because either the system was not designed properly, the worker did not understand the system, there was a conscious decision not to take the proper action on the part of management or the employer, or a mechanical failure occurred. The limited focus on personal protective equipment and behavior ignores all other causative factors.*

### **OIG's Commentary**

The report does not discount the significance of additional factors already studied by MSHA as possibly relevant to fatalities. However, our goal was to focus on factors contributing to fatal accidents not fully stressed by MSHA, or stressed fully in relationship to other variables - we did not want to simply revisit MSHA's analyses. The relevancy of our methodology became particularly apparent after we reviewed various internal fatality analyses shared by MSHA officials, and compared them to what we saw in the fatality reports. After we examined the reports, it was obvious that numerous behavioral factors contributed to fatalities, including not just unsafe behavior related to PPE, but also miner use of alcohol and/or drugs, operating vehicles recklessly and/or at excessive speeds, failing to de-energize or properly ground equipment, and being crushed or run over by unsecured mine equipment. We did not see, however, any discussion or analysis of behavioral factors or PPE in the narrative fatality analyses provided to the OIG by MSHA shortly after our entrance conference.

Additional fatality analyses conducted by MSHA for 1998 and 1997, and also shared with the OIG, excluded PPE issues as distinct, or even related categories. For example, graphs and charts showing fatalities in categories such as "powered haulage" did not indicate whether a seat belt was used in the accident – even though a seat belt obviously could have been a highly relevant factor in the fatality. Later in our review, we discovered additional MSHA analyses which did address the level of seat belt use in accidents and fatalities. These analyses did have a PPE focus, but still did not address behavioral issues. Thus, while MSHA determined that miner use of seat belts was often low - the issue of why miners made decisions not to buckle was not discussed. As a result, we determined that our methodology, which combined a discussion of all forms of PPE (not only seat belts) within the context of miner behavior, was

important. Our analysis should be viewed as providing additional insight and perspective on fatalities to MSHA, the miners, and the public. It is not intended as a comprehensive study of all the causal factors which contribute to fatal accidents.

When we determined that a significant number of miners were not using PPE and engaging in unsafe behavior, it led us to our research on risk-taking behavior. The issue of risk-taking in the workplace is not a narrow field of inquiry. In fact, most safety experts acknowledge that risky and unsafe behaviors play a significant role in workplace accidents. There is extensive research on this topic, and we provided relevant research sources to MSHA in our bibliography.

In regard to PPE, we are normally not dealing with a “system failure,” except possibly in the small number of cases where PPE was not provided. PPE use decisions are generally made by the individual miners. As noted in the report, engineering controls such as berms, ROPs, etc. are sometimes inadequate, and miners must then rely on PPE (see page 4).

Finally, in some cases, the “hierarchy” of accident prevention and control is intertwined. For example, when a miner is suspended 150 feet over a mine shaft and tied off with a safety line, “engineering controls” and PPE are one in the same.

A reality in mining which should not be dismissed is that miners do sometimes engage in risky behavior. The goal of our recommendations is to reduce risk-taking behavior and prevent miners from becoming victims.

### **MSHA's Comments on the Report's Data Analysis**

*The data analysis conducted for the report demonstrates the fallacy of examining “causes” or “contributing factors” out of context. In attempting to link a miner's failure to use PPE and a fatal accident, the OIG disregards critical facts that negate the PPE factor. For example, the report refers to an accident where a miner was “struck in head by large tire” and mentions a “hard hat” as the relevant PPE. The facts of the case are: The victim was working beneath a 2,660 lb. tire that was suspended from a crane. The shop-fabricated bead hook from which the tire was suspended did not secure the tire from falling while it was being lifted and moved. The victim's head and neck were crushed under the tire. While the victim was not wearing a hard hat to prevent head injuries (MSHA cited this failure), the protection afforded by a hard hat against the weight of the tire would not have prevented the employee's death.*

*In another example, the report refers to an accident where the victim fell from a ladder and his safety line was too long and it mentions “safety belt/line” as the relevant PPE. The facts of the case are: A miner had entered a bin wearing a safety belt, lanyard and lifeline. He had tied off on the walkway and had entered the bin. A second miner was assigned to attend the lifeline. During the cleanout procedure the victim fell during a time when the man assigned to the lifeline was distracted and had left his position. The line was too long and allowed the victim to be engulfed in the material within the bin. All PPE was worn, though improperly adjusted. Procedure was*



*violated when the lifeline attendant left his post. This was not a failure to wear PPE, but a deficiency in training.*

*These are just two examples (please see attachment for further analysis) of how simplistic analyses can distort conclusions and lead to fruitless recommendations. MSHA believes that constructive analysis must examine all conditions, systems and behaviors that are relevant to the accident. We cannot forget that we are investigating human behavior- neither workers or managers are robots and most do not deliberately engage in unsafe acts. If we want to continue making progress reducing workplace injuries and illnesses, we need a better appreciation and understanding of all of the factors that lead or cause us to behave as we do- management styles, production pressures, workplace environment, etc. etc., etc.*

### **OIG's Commentary**

We stipulated clearly in our report that PPE use cannot guarantee that a miner will not be killed or seriously injured while working in the mines, however, PPE use can greatly decrease the likelihood of death or serious injury.

We disagree with MSHA's contention that critical facts which negate the PPE factor were disregarded. In the first example cited, MSHA maintains that the protection afforded by a hard hat against the weight of the tire would not have prevented the employee's death. In our study of PPE, we identified cases where workers wearing hard hats survived after being hit in the head with blunt force as severe or greater than in the hard hat related fatality cited by MSHA. Further, MSHA's own investigation report stated, "the employee was not wearing a hard hat to prevent head injuries. Cause of death was attributed to blunt force trauma to the head. The company has trained employees in the use of and instructed them to wear hard hats where a hazard to the head exists."

As for MSHA's second example, according to the accident investigation report, "the victim fell from the ladder while trying to knock down the material and became engulfed because his lifeline was too long." The MSHA investigation concluded that failure to have a second person stationed near the lifeline to prevent excessive slack was a contributing factor in this death and cited the operator at 30 CFR 56.16002(c). We view this accident as an obvious PPE/risk-taking related fatality. The victim in this case, who had received annual refresher training in accordance with Part 48, should not have been working without a second person available to curb slack.

Finally, it was MSHA not the OIG who conducted these accident investigations. In 51 of these fatalities, MSHA concluded that failure to utilize PPE was a contributing or causal factor. Another 8 fatalities were PPE related, involving a more complex combination of miner behavior and PPE use. Three (3) other fatalities occurred in vehicles where MSHA currently has no regulatory authority to require seat belts. Miners do work under pressure and in environments which may not necessarily be conducive to PPE use, this is why our report's recommendations are important.

### MSHA's Comments on the Report Findings

*The report states that failure to utilize personal protective equipment is a significant factor in fatalities in metal and nonmetal mines. The report states that failure to use PPE does not necessarily cause fatal accidents but the report provides no estimate of how many fatalities would have been prevented through the use of such equipment.*

*In fact, failure to use PPE rarely **causes** an accident. As is correctly noted in the OIG report, PPE can be a major factor in the severity of an accident. However, the most PPE can do is protect the worker in case of one of the system failures noted above.*

*This is an extremely important distinction. It is MSHA's position, as well as the other agencies responsible for occupational safety and health, that the best way to reduce accidents and injuries is to prevent their occurrence by **eliminating the causes**. Personal protective equipment is integral to an effective safety and health program; but it is critical to make clear the Agency's position is and will continue to be that MSHA will, first and foremost, continue to focus our efforts on **accident prevention**. As the record for accident reduction indicates, accident prevention has allowed the U.S. to become the world's leader in mine safety.*

*Additionally, the report suggests that safety training may not prevent risk-taking by miners, pointing to the fact that miners were killed while working at mines where training was "often" provided. However, in over half of the fatal accidents cited in the OIG report, there was no indication that the victim received any safety training whatsoever. Further, no qualitative evaluation was made of the training that the other victims received. Without such information, it is difficult to conclude that such training is ineffective in deterring risk-taking behavior.*

### OIG's Commentary

We agree, as stated by MSHA in their response to our report, that "PPE can be a major factor in the severity of the accident." Thus, it is possible that a significant number of miners may have survived these accidents had they been using PPE. In addition, we see no conflict between focusing on accident prevention and promoting PPE use. The use of PPE may prevent accidents from becoming serious or fatal.

In Appendix A we included information on training, when it was available in the investigation report (the fatality victim's prior PPE related training was not always discussed by the accident investigators). Based on this data, at least half (see Appendix A) of the miners killed did receive formal or informal training. Such training at Part 48 and Part 46 covers a wide variety of topics, well beyond any specific focus on risk-taking and PPE use, and it should not be confused with the supplemental type of training we recommend in our report (see recommendation #1). The fact that such a significant number of miners had received training, yet did not use PPE, establishes to our satisfaction that better training, as well as the other recommendations in our report, are required.

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**Appendix A**

**M/NM Mining Fatalities Pertaining to  
Personal Protective Equipment 1995-1998**

### Miner Fatalities where MSHA Investigators Concluded that non-use of PPE was a Factor

#1 02/02/95 Seat belt

Description: Miner's front end loader rolled into 30 foot pit.

Training: Verbal seatbelt policy in place.

**Conclusion of MSHA Investigators:** "Contributing to the severity of injuries sustained was the failure to wear the seatbelt provided."

#2 03/14/95 Seat belt

Description: Miner rolled truck on mine road.

Training: Victim had received training in accordance with Part 48.

**Conclusion of MSHA Investigators:** "Contributing to the severity of the accident was failure of the water truck driver to wear the provided seat belts."

#3 05/31/95 Safety belt/line

Description: Miner fell 42 feet from conveyor.

Training: Part 48 exemption of the operator was noted in the report.\*

**Conclusion of MSHA Investigators:** "The accident was directly caused by the performance of work from an unsafe location. There was danger of falling but no safety belt and line was used." "Safety belts and lines were available, but were not being worn."

#4 06/09/95 Safety belt/line (victim was a foreman)

Description: Fall

Training: Operator had an MSHA-approved training plan and training records reviewed indicated that the employees had received the required training under Part 48 and the training was kept current.

**Conclusion of MSHA Investigators:** "The accident was directly caused by working from the top of an unsecured 10-ft ladder. A contributing factor was the failure to use a lanyard and safety belt while working in an unsafe elevated position where there was a danger of falling." "A safety belt and line was not worn and used and there was an obvious danger of falling."

#5 08/15/95 Hard Hat

Description: Miner struck in head by sheet metal.

Training: Verbal Policy-see below

**Conclusion of MSHA Investigators:** "a hard hat should always be worn in areas where the hazard of falling objects exists. In this accident, the victim survived for several days. His injuries may have been lessened if a hard hat had been worn." "Contrary to instructions from the site superintendent, he was out of the truck cab without a hard hat."

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\*A notation in the fatality report that a victim had not received training in accordance with Part 48, does not necessarily mean that the victim was unaware of PPE and its proper use. In many of these cases, the victim's prior awareness regarding the role and use of PPE was not discussed by the accident investigators.

#6 09/01/95 Safety belt/line  
Description: Fall  
Training? Part 48 exempt\*, although prior PPE training not discussed in investigative report. Mine operator had gone 26 years without a lost time accident.

**Conclusion of MSHA Investigators:** “The victim was standing on the elevated conveyor belt in the area of the head pulley, 30 feet above the dock. He was using a water hose to wash out the transfer chute. He was not wearing a safety belt and line.” “The use of a safety belt and line could also have prevented the fall.”

#7 09/07/95 Protective Clothing  
Description: Electrocution  
Training: The mine had an approved MSHA 30 CFR Part 48 Training Plan - company records that the victim had received all the required MSHA training.

**Conclusion of MSHA Investigators:** “The primary cause of the accident was the failure to de-energize the damaged, 480 volt, power cable before grasping it and attempting to disconnect it from the intake face fan. A contributing factor was the failure to use suitable protection for persons while handling the damaged energized power cable.”

#8 09/18/95 Seat Belt  
Description: Miner lost control of dozer, died from blunt trauma.  
Training: Part 48 exempt.\* Prior PPE training not discussed in investigative report.

**Conclusion of MSHA Investigators:** “The equipment operator, involved in a fatal accident, was not wearing a seat belt.” “Seat belts were provided but not in use.”

#9 09/21/95 Safety belt/line  
Description: Fall  
Training: The victim had received annual refresher training, in accordance with Part 48.

**Conclusion of MSHA Investigators:** “The primary cause of the accident was the performance of work from an unsafe, elevated position without a safety belt and line.” “The victim was not wearing a safety belt and line to prevent him from falling.”

#10 12/12/95 Life Jacket  
Description: Drowning  
Training: Part 48 exemption.\*

**Conclusion of MSHA Investigators:** “The direct cause of the accident was failure to wear a life jacket while performing work where there was danger of falling into water. A contributing factor may have been the victim had a 0.20% ethyl alcohol blood level at the time of the accident.” “Life jackets were available but not in use on the day of the accident.

#11 1/25/96 Seat Belt  
Description: Miner backed through berm over dump and was ejected through rear cab window.  
Training: The operator had an approved training plan required under Part 48.

**Conclusion of MSHA Investigators:** “Contributing to the severity of injuries sustained was failure to wear the seatbelt.”

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\*A notation in the fatality report that a victim had not received training in accordance with Part 48, does not necessarily mean that the victim was unaware of PPE and its proper use. In many of these cases, the victim’s prior awareness regarding the role and use of PPE was not discussed by the accident investigators.

**#12-13** 4/17/96 Life Jacket (double fatality)

Description: Drowning

Training: Victims had received training in accordance with Part 48

**Conclusion of MSHA Investigators:** “Failure to wear life preservers contributed to the severity of the accident.” Life jackets had been issued to the victims. It was determined that one of the victims could not swim.

**#14** 05/10/96 Safety belt/line

Description: Fall

Training: The victim had received training in accordance with Part 48.

**Conclusion of MSHA Investigators:** “The direct cause of this accident was failure to use a safety belt and lanyard when moving the wooden plank used to install bolts to the elevated hopper.” “A safety harness was provided at the site, but was not being worn when the accident occurred.”

**#15** 5/18/96 Seat Belt

Description: Miner drove off mine road.

Training: Covered under Part 48, though not reporting mine activity to MSHA

**Conclusion of MSHA Investigators:** “Contributing to the severity of the accident was the failure to replace the dump truck doors and to provide seat belts.”

**#16** 5/28/96 Hard Hat (victim was corporate official)

Description: Blow to head from falling materials

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “Contributing to the possible severity of the injury was the failure to use hard hats where there was a danger of falling material.”

**#17** 08/07/96 Safety belt/line

Description: Fall

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “The cause of accident was failure to use the available fall protection equipment at the load-out facility.”

**#18** 09/10/96 Life Jacket

Description: Drowning (prior fall from dredge pipeline)

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “Failure to wear personal flotation devices, where there was danger of falling into the water, contributed to the severity of the accident.” Life jackets were provided, but usually not worn by employees when accessing dredge.

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\*A notation in the fatality report that a victim had not received training in accordance with Part 48, does not necessarily mean that the victim was unaware of PPE and its proper use. In many of these cases, the victim’s prior awareness regarding the role and use of PPE was not discussed by the accident investigators.

#19 09/12/96 Safety belt/line

Description: Fall

Training: The victim had received training in accordance with 30 CFR Part 48.

**Conclusion of MSHA Investigators:** “The primary cause of the accident was the victim working from an unsafe position in the raise without using a safety belt and lanyard.”

#20 09/16/96 Safety belt/line

Description: It was determined that the victim was rendered unconscious after a 25 foot fall, and died as a result of being covered by hot materials.

Training? Victims prior PPE training is unclear, the report notes that operator had trained and furnished safety belt/lines to some of its employees on proper safety belt/line use.

**Conclusion of MSHA Investigators:** “Contributing to the severity of one of the victims was the failure to use safety belts and lines while working in an area where there was danger of falling.”

#21 11/18/96 Seat Belt

Description: Miner drove vehicle off road and rolled - suffering fatal head injuries.

Training: Victim had been trained as required by Part 48.

**Conclusion of MSHA Investigators:** “a passenger was fatally injured and the driver slightly injured when a 2-1/2 ton International truck over-traveled the outer edge of a mine access road. Neither occupant was wearing provided seat belts at the time of the accident.” “Failure to wear seat belts may have contributed to the severity of the accident.”

#22 12/12/96 Seat Belt

Description: Fork lift overturned causing the employee to be partially thrown from the operator's compartment and pinned under the unit's canopy. The victim died from crushing injuries

Training: A warning label on the underside of the forklift's FOPS instructed the driver to "fasten belt."

**Conclusion of MSHA Investigators:** “Contributing to the severity of the accident were the lack of a company policy requiring forklift operators to wear seatbelts, and the victim's failure to wear the provided seatbelt.”

#23 02/24/97 Seat Belt

Description: Intoxicated Miner drove truck into pond and was pinned in vehicle and drowned.

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “Contributing to the severity of injuries was the fact that the victim was not wearing the seatbelt provided in the vehicle.”

#24 02/26/97 Safety belt/line

Description: Fall

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “a surface miner was fatally injured in a rock fall. He was drilling near the perimeter of a highwall, where there was a chance of falling and was not tied off with a safety belt and line. “The lack of a safety belt and line contributed to the severity of the accident.”

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\*A notation in the fatality report that a victim had not received training in accordance with Part 48, does not necessarily mean that the victim was unaware of PPE and its proper use. In many of these cases, the victim's prior awareness regarding the role and use of PPE was not discussed by the accident investigators.



#25 03/15/97 Hard Hat

Description: Miner struck in head by large tire.

Training: See below

**Conclusion of MSHA Investigators:** “The employee was not wearing a hard hat to prevent head injuries. Cause of death was attributed to blunt force trauma to the head. The company has trained employees in the use of and instructed them to wear hard hats where a hazard to the head exists.”

#26 04/27/97 Safety belt/line

Description: Fall

Training: The company had no records to show that the victim had received training in accordance with Part 48.

**Conclusion of MSHA Investigators:** “The victim failed to use a safety belt and line restraint system at the truck wash area behind the lime plant.” The investigators concluded that management failed to enforce use available of safety belt and line restraint systems.

#27 05/05/97 Life Jacket

Description: Drowning

Training: Investigative report states that the victim had not received training in accordance with Part 48. Victim's knowledge of proper life jacket use is not discussed. The victim had 28 years of mining experience, was partially paralyzed, and could not swim.

**Conclusion of MSHA Investigators:** “The accident occurred because the victim, who was unable to swim, entered the water to maneuver a work boat without benefit of a life jacket or other floatation device.” Life jackets were stored in the mechanic shop in their original wrappers.

#28 06/20/97 Hard Hat

Description: Miner struck in head by fender of front end loader during maintenance.

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “Failure to wear a hard hat was a contributing factor to the severity of the injury.”

#29 06/25/97 Safety belt/line

Description: Fall

Training: The company informed MSHA that the victim had received training on fall protection, no records were available however.

**Conclusion of MSHA Investigators:** “The employee opened an outer elevator shaft door without the passenger compartment being in position on the floor he was on. The employee was not wearing a safety belt and line to prevent his falling into the shaft.”

#30 07/16/97 Safety belt/line

Description: Fall (victim was a mine agent)

Training: Victim had received training in accordance with Part 48.

**Conclusion of MSHA Investigators:** “The failure to wear a safety belt and line while working where there was a danger of falling contributed to the severity of the accident.” “The company president had sent a letter to all employees approximately a month before the accident, stating that they were expected to use a safety belt and line when working near the edge of a highwall. However, this blast crew, which included the two agents of the contractor who were involved in the accident, chose to ignore these instructions.”

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\*A notation in the fatality report that a victim had not received training in accordance with Part 48, does not necessarily mean that the victim was unaware of PPE and its proper use. In many of these cases, the victim's prior awareness regarding the role and use of PPE was not discussed by the accident investigators.

#31 07/24/97 Hard Hat (victim was an owner-consultant)

Description: Locomotive truck assembly struck victim in head.

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “Failure to use protective head wear contributed to the severity of the accident.”

#32 07/25/97 Seat Belt

Description: Victim thrown into the windshield and then through the right door's window.

Training: The company had a policy which required the use of seat belts while operating mobile equipment. The victim had received 8-hours of task training.

**Conclusion of MSHA Investigators:** “The truck was equipped with seat belts that met SAE criteria. The truck driver, however, was not wearing the seat belt at the time of the accident, and it was found tucked behind the seat.” “The primary cause of the accident was the inadequate construction of the berm. Contributing factors were the truck contacting the berm and the failure of the driver to wear the seat belt provided.”

#33 08/19/97 Safety belt/line

Description: Fall

Training: Victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “Failure to use safety belts and lines contributed to the severity of the accident.” Safety harnesses, belts, and lanyards were available onsite.

#34 08/28/97 Cap Lamp

Description: Miner run over by mine vehicle.

Training: Victim had initially received newly employed inexperienced Miner Training and was in the process of completing his task training at the time of the accident.

**Conclusion of MSHA Investigators:** “The accident was caused by the unsafe location of the victim, and the failure to utilize a cap lamp which would have illuminated the victim's position. The victim's blood alcohol content of .229 also contributed to his inability to remain attentive to the traffic in the area.”

#35 09/03/97 Safety belt/line

Description: Fall

Training: Victim was trained in accordance with Part 48 and had received annual refresher training.

**Conclusion of MSHA Investigators:** “Contributing to the severity of the accident was the failure to wear a safety belt and line while conducting drilling operations near the edge of the highwall.” The victim's safety belt was found lying against the brake pedal in the cab of the truck located 60 feet from the drill hole.

#36 09/28/97 Life Jacket (victim was mine foreman)

Description: Drowning

Training: Victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “Contributing to the severity of the accident was work being performed in an area where there was a danger of falling into the water without a life jacket being worn.”

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\*A notation in the fatality report that a victim had not received training in accordance with Part 48, does not necessarily mean that the victim was unaware of PPE and its proper use. In many of these cases, the victim's prior awareness regarding the role and use of PPE was not discussed by the accident investigators.

**#37 09/30/97** Seat Belt

Description: Miner's vehicle rolled over, throwing him from the seat and pinning him under the rollover protective structure.

Training: Victim had not received training in accordance with Part 48, however, he previously overturned while driving over the outer edge of a stockpile. During the previous roll-over (the scraper was equipped with seat belts and ROPS) the victim was wearing a seat belt and was not injured

**Conclusion of MSHA Investigators:** "Failure to wear seat belts contributed to the severity of the accident."

**#38 10/20/97** Safety belt/line (victim was corporate official)

Description: Fall

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** "The accident was caused by the failure to de-energize and lock out the crusher prior to accessing the platform adjacent to the crusher opening. Failure to provide and assure the use of safety belts and lines were contributing factors."

**#39 10/27/97** Life Jacket

Description: Fall from work boat into water.

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** "The failure to wear a life jacket contributed to the severity of the accident." The victim was found 50 feet under water. Life Jacket found floating inside the work boat.

**#40 01/19/98** Seat belt

Description: The victim was thrown through truck windshield.

Training: This Spanish speaking victim had not received training in accordance with Part 48. However, the victim had attended meetings conducted by MSHA in which the requirement to wear seat belts was stressed. In addition, the operator's verbal policy seat belt policy was communicated in Spanish. The operator also appeared to have properly enforced its seat belt policy. Drivers were warned that they would be disciplined if found out of compliance. The victim had also been found to have worn his seat belt in the past. *Jobe Concrete Products Inc.*, 21 FMSHRC 1143 (October 1999).

**Conclusion of MSHA Investigators:** "Failure to wear a seat belt contributed to the severity of the accident."

**#41 01/19/98** Safety belt/line

Description: Fall

Training: The victim had not received training in accordance with Part 48, although a safety harness and line were available - and the report noted that a sign next to the stairway leading to this floor had been posted by the operator for their plant employees and instructed them to use a harness and line when entering bins."

**Conclusion of MSHA Investigators:** "The victim was not wearing a safety belt and line when he fell." "Management's lack of procedures to ensure usage of a safety belt and line contributed to the severity of the accident."

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\*A notation in the fatality report that a victim had not received training in accordance with Part 48, does not necessarily mean that the victim was unaware of PPE and its proper use. In many of these cases, the victim's prior awareness regarding the role and use of PPE was not discussed by the accident investigators.

#42 01/21/98 Hard Hat/Safety belt and line

Description: Fall and blow to head.

Training: The victim had received training in accordance with Part 48.

**Conclusion of MSHA Investigators:** “A safety belt and line was not available at the site for the victim to use.” “The victim (and other employees) was not wearing a hard hat. Injuries received from the hammer handle blow and the fall may have been less severe had head protection been worn.” The victim died eight days later as the result of a skull fracture.

#43 01/27/98 Safety belt/line

Description: Fall

Training: The victim had received training in accordance with Part 48. Annual refresher training had been conducted.

**Conclusion of MSHA Investigators:** “The accident was caused by lack of an effective program to ensure the use of personal fall protection when working around the open shaft and to ensure that the open shafts were covered. When questioned, employees indicated that swinging the suspended skips/cages over the open shaft to rotate them, without using personal fall protection or covering the shafts, had been a practice.” The victim was wearing a safety belt but did not tie off.

#44 03/14/98 Safety belt/line

Description: Fall

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “The primary cause of the accident was failure to lock out the feeder gate prior to working on top of the surge pile. Failure to wear a safety belt and line greatly contributed to the severity of the accident.”

#45 04/28/98 Safety belt/line

Description: Fall from Conveyor

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “The accident was caused by failure to stop the conveyor before attempting to clean an elevated pulley. Contributing to the severity of the injuries may have been the fall.” The fatalgram for this accident notes that “where there is a danger of falling, persons should wear safety belts and lines.”

#46 05/06/98 Safety belt/line (victim was foreman/co-owner)

Description: Fall

Training: The victim had received training in accordance with Part 48. Annual refresher training had been conducted.

**Conclusion of MSHA Investigators:** “The foreman at this operation was fatally injured on May 6, 1998, when he fell from the south high wall area to the quarry floor, a distance of about 60 feet.” “He was not wearing a safety belt and line that was located nearby in his company vehicle.”

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\*A notation in the fatality report that a victim had not received training in accordance with Part 48, does not necessarily mean that the victim was unaware of PPE and its proper use. In many of these cases, the victim’s prior awareness regarding the role and use of PPE was not discussed by the accident investigators.

#47 05/14/98 Seat belt

Description: Victim backed his truck off a stockpile.

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “The truck was equipped with side view mirrors and functional seat belts. The victim was not wearing the seat belt.”  
“Failure to use a seat belt may have contributed to the severity of the accident.”

#48 09/02/98 Seat belt

Description: Victim’s bulldozer overturned in the pit.

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** “The direct cause of the accident was attempting to travel the pit bench which was too narrow to support the size and weight of the bulldozer. Failure to wear seat belts contributed to the severity of the accident.” The seat belt in this case was usable but not fully adjustable.

#49 09/22/98 Safety belt/line

Description: Fall

Training: The mine operator had a verbal policy prohibiting persons from walking onto surge piles and had administered disciplinary action for not adhering to it. This policy had been discussed several times in safety meetings during the previous year.

**Conclusion of MSHA Investigators:** “The accident was caused by failure to shut off and lock-out the discharge equipment and by walking on the surge pile without wearing a safety belt and lifeline.”

#50 11/09/98 Seat belt

Description: Victim drove truck over edge of stockpile.

Training: The victim had not received training in accordance with Part 48.\*

**Conclusion of MSHA Investigators:** ““Failure to wear seat belts contributed to the severity of the accident.” The truck was equipped with seat belts.

#51 11/13/98 Safety belt/line (victim was a foreman)

Description: Fall (from bin)

Training: The victim had not received training in accordance with Part 48. The report noted that routinely, full-body harnesses with short lanyards were worn while in the liftbasket and while working above ground on the bin

**Conclusion of MSHA Investigators:** “The accident was caused by failure to use the safety harness and lifeline while working on the bin.”

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\*A notation in the fatality report that a victim had not received training in accordance with Part 48, does not necessarily mean that the victim was unaware of PPE and its proper use. In many of these cases, the victim’s prior awareness regarding the role and use of PPE was not discussed by the accident investigators.

## Miner Fatalities where non/improper PPE use and Unsafe Behaviors/Training were Associated

- #1** 01/11/96    Seat belt/training Seat  
Description:    Victim was fatally injured while riding unsecured on the outside of the cab during training.  
Comments:        The accident report concluded that the cause of the accident was lack of provision for secure travel while training was being conducted. The miner killed was in a very precarious position riding outside the cab while being trained. This is a case of poor training and overt risk taking by all parties. In cases like this, the operator can provide secure travel via a “training seat” with a seat belt.
- #2** 02/06/96    Seat belt related  
Description:    The victim was fatally injured when he was crushed between the lift arm and the roll-over protective structure of a small utility loader.  
Comments:        Miners should not generally remove their seatbelts while their vehicles are operating. In this case, the victim had gotten out of the seat, while the loader was running. The investigative report noted that the vehicle’s instruction manual stated that users should; 1) keep seat belts fastened; 2) never leave the operator’s seat without first lowering the lift arm, or engaging the lift arm stops, and shutting off the engine, 3) never attempt to work the controls unless properly seated.
- #3** 07/19/97    Seat belt/safety bar  
Description:    Miner left seat and was pinned via vehicle lift arm  
Comments:        Miners should not generally remove their seatbelts while their vehicles are operating. The accident report states that, “the miner left the operator’s seat to adjust a shop fabricated component on the equipment, placing himself in an unsafe position.” Also, in this fatality, the seat belt was never worn with the accident report noting that “the seatbelt was tucked behind the seat with extraneous material on it.” The report also concludes that the safety seat bar (*which is a form of PPE*) was intentionally bypassed. Manufacturers’ safety and warning decals were in place and readable in the operator’s compartment, and that the operator’s handbook was in the cab.
- #4** 07/23/98    Seat belt related  
Description:    Vehicular Accident  
Comments:        In this case, an intoxicated miner’s trailer jack-knifed. The MSHA fatalgram for this death indicates that the miner may not have been wearing his seat belt.
- #5** 08/21/98    Safety belt/line related  
Description:    Victim fell from the rope ladder he had been working from and became engulfed in materials.  
Comments:        According to the accident investigation report, the victim “fell from the ladder while trying to knock down the material and became engulfed because his lifeline was too long. Failure to have a second person stationed near the lifeline to prevent excessive slack was a contributing factor.” The victim had received annual refresher training in accordance with Part 48. The operator was cited at 30 CFR 56.16002(c) for there not being a second person available to curb slack.
- #6** 08/28/98    Electrical PPE (gloves)  
Description:    Mine superintendent’s hand came in contact with energized/damaged cable  
Comments:        Protective gloves may have prevented this fatality. As indicated by the MSHA fatalgram for this accident, “Insulated gloves should be used when handling energized cables.” Requirement for their use is defined at 57.12014.

- #7 12/07/98** Life Jacket  
 Description: Miner drowned after overloaded pump station capsized.  
 Comments: As noted in the MSHA fatalgram, the victim in this accident was not using his life jacket. MSHA 's regulation on life jackets is unambiguous - with 56.15020 stating that, "life jackets should be worn where there was danger of falling into water." This includes pump stations. In the victim's (Yates) case, a life jacket may have prevented his drowning. Although a miner involved in the accident (Forsell) *was* forced under water by the pumpstation (and survived) we do not know what happened to the victim after the pump station capsized (his body had to be located by divers). It appears that MSHA could have cited 56.15020 here.
- #8 11/03/98** Life Jacket  
 Description: Miner fell from dock and drowned.  
 Comments: The victim was found submerged in water near the plant's boat dock. The river where the miner drowned was adjacent to his assigned work area, and the miner's forklift was found 72 inches from the dockrail. MSHA 's regulation on life jackets at 56.15020 states that, "life jackets should be worn where there was danger of falling into water."

**Miner Fatalities where MSHA has no Regulatory Requirement for PPE Use**

- #1 08/03/95** Seat belt  
 Description: Miner overturned front-end loader into an excavation and was killed.  
 Comments: A seat belt was unavailable to the miner. MSHA regulation (56.14130) requires that wheeled loaders, such as the one involved in this accident, have ROPS and seat belts if manufactured on or after July 1, 1969. The vehicle in question was manufactured in 1968.
- #2 04/03/96** Seat belt  
 Description: Miner thrown from loader while in operation and run over by same vehicle.  
 Comments: A seat belt was unavailable to the miner. There is no standard requiring that loaders used in underground operations have seat belts.
- #3 09/28/98** Seat belt  
 Description: Miner killed in collision with another vehicle. The victim entered the intersection with his lights off (it was after sunset) and was run over by an approaching haul truck.  
 Comments: The MSHA investigators concluded that "failure to wear the seat belts in the service truck may have contributed to the severity of the accident." However, there is no requirement for the use of seat belts in the service truck the victim was operating.

**Appendix B**

**Studies on Seat Belt/Restraint System Use by Miners**



## Studies on Seat Belt/Restraint System Use by Miners

### 1. *MSHA's review of Coal and Metal/Nonmetal Surface haulage Accidents, 1987-1996*<sup>1</sup>

This study supported MSHA's July 30, 1998 Notice of Proposed Rulemaking at 30 CFR Parts 56, 57, and 77, Safety Standards for Surface Haulage Equipment (63 FR 40800). It determined that:

- < Seat belts were not used in 73 of 78 overall (coal and M/NM) fatal surface haulage accidents between 1987-1996.<sup>2</sup>
- < Seat belts were not worn in 49 of 51 M/NM surface haulage fatalities between 1987-1996.

In the July 30, 1998 notice, MSHA stated that 30 % of the fatal mining accidents at surface mines and surface areas of underground mines over the prior three years involved surface haulage equipment. Further, this equipment was cited as the primary cause in 40 percent of the fatalities in 1997 in M/NM mining.

### 2. *MSHA's Analysis of Surface Powered Haulage Accidents, January 1990-July 1996*<sup>3</sup>

In this study, the primary focus was on 1,300 truck haulage accidents, of which 640 resulted in traumatic injuries such as severe cuts, burns, broken limbs and internal injuries. 139 accidents of these accidents resulted in fatalities. Study conclusions:

- < In more than 200 accidents - equipment operators failed to use seat belts.
- < Failure to use seat belts always resulted in more serious injuries in accidents involving trucks and berms.
- < There is a misconception among equipment operators that it is usually better to jump from an out-of-control vehicle than to ride it out. In nearly every instance the condition of the equipment operator's compartment indicated the drivers would have been protected if they had worn their seat belts.

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1 Data provided by MSHA to the OIG. Data created May 1997-January 1997, D.A. Cash, Mining Engineer, Technical Support, MSHA

2 Ten (10) of the fatalities occurred on pickup and service vehicles equipment that would not be required under the M/NM regulations to have seat belts.

3 Presented at the twenty-seventh annual meeting of the Institute on Mining Health, Safety, and Research, *Analysis of Surface Powered Haulage Accidents*, January 1990-July 1996, George M. Fesak, Rodric M. Breland, Jack Spadero, MSHA.

### **3. Bureau of Mines - *Review of Accidents During Surface Mine Mobile Equipment Operation 1989-1991***<sup>4</sup>

The study examined 2,852 mining accidents overall and 163 mining accidents where seat belt use could be determined. It concluded that haulage fatalities are preventable if miners wear seat belts, but that seat belts were worn in only 45% of powered haulage accidents. Specifically:

- < When belts were worn, no fatalities occurred and accidents caused an average of 31 lost workdays. In contrast, when belts were not worn, 8 fatalities occurred and accidents caused an average of 41 lost workdays. An additional 4 miners were killed when they jumped from moving vehicles.
- < Loss of control accidents caused 29 of 47 fatalities during the study period. In accidents involving vehicle rollovers, no fatalities occurred when miners wore their seat belts, and an average of only 18 workdays were lost. In contrast, four fatalities occurred in rollover accidents where the miner was not wearing a seatbelt and lost work time rose to 44 days.
- < Overall accidents involving mobile equipment made up only 12% of all surface mining accidents but caused 39% of mining fatalities. Haulage trucks accounted for the largest number, and most severe, accidents.

The study called for better restraints for vehicle operators and suggested that operators wear them every time they get in their vehicles. The study said these improvements, along with better shocks to eliminate jarring, could potentially eliminate or lessen the severity of 60% of operator accidents.

### **4. *M/NM Truck Accidents Related to Seat Belts, 1982-1984***<sup>5</sup>

This study examined M/NM truck accidents between 1982-1984, and found that failure to use seat belts was a factor in 42% of M/N haulage truck accidents.

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4 Presented at the Twenty-fifth annual meeting of the Institute on Mining Health, Safety, and Research, A Review of Accidents During Surface Mine Mobile Equipment Operation, J. Aldinger, C. Keran, August 1994.

5 See Mason, *M/NM Truck Accidents Related to Seat Belts, 1982-1984*. MSHA PC 7016, March 1987.

**Appendix C**

**Selected Bibliography/Research Sources**

## Selected Bibliography/Research Sources

### Books and Publications

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LaBar, G.(5/1/98) WL 15157423 Occupational Hazards Vol. 60, No. 5 *Is Behavioral Safety the Missing Piece?*

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Minter, S. (10/1/90 ) WL 2634293 Occupational Hazards, *The Psychology of Safety: Risk Perception and Safe behavior.*

Minter, S. (10/1/90 ) WL 2634344 Occupational Hazards, *A New Perspective on Head Protection.*

Topf, Michael D (8/1/98 WL 33329052 Professional Safety Vol. 43, No. 8 *Behavioral safety: A multifaceted approach.*

Topf, Michael D (8/1/97) WL 10435316 Occupational Hazards Vol. 59, No. 8, *20 Lessons for safety trainers (safety training for employees).*

Topf, Michael D (6/1/99) WL 25086954 Occupational Health & Safety Vol. 68, Issue 6;  
*Chicken/egg/chegg.*

Topf, Michael D (9/1/99) WL 12401553 Occupational Hazards Vol. 61, Issue 9; *"Eenie, meenie,minie...NO!"*

Weinstein, ND (12/8/89) WL 3078179 Science , *Optimistic biases about personal risks.*

Bibliography Note: While by no means comprehensive, our bibliography provides an overview of the issues surrounding cognitive/behavioral safety training, in addition to detailed information on risk taking behavior and workplace accidents. A review of these materials will show that there are different forms of cognitive/behavior oriented safety programs currently in use in the workforce. These run the spectrum from full fledged “behavior based safety”(BBS) programs which require ongoing monitoring and self-assessment by management and employees to identify and correct unsafe behaviors; through more basic programs which integrate basic cognitive/behavioral training methods as a component of an overall safety strategy.

**Appendix D**

**MSHA's Written Responses  
(Dated January 27 and April 21, 2000)**

U.S. Department of Labor

Mine Safety and Health Administration  
 4015 Wilson Boulevard  
 Arlington, Virginia 22203-1984



JAN 27 2000

MEMORANDUM FOR JOSE M. RALLS  
 Acting Assistant Inspector General for  
 Analysis, Complaints, and Evaluations

FROM: EARNEST C. TEASTER, JR.,  
 Administrator for  
 Metal and Nonmetal Mine Safety and Health

SUBJECT: Review of Fatal Accidents in  
 Metal and Nonmetal Mining 1995-1998  
 Report No. 2E-06-001-0004

By memorandum dated November 1, 1999, you forwarded to us the preliminary draft report by the Office of Inspector General of a study of factors that influence fatal accidents in the metal and nonmetal sector of the mining industry. The draft report contains the findings, conclusions, and suggested recommendations resulting from that study. We have reviewed the preliminary draft report, and our responses to the specific recommendations in the report are provided below:

**OIG Draft Recommendation #1**

MSHA should propose amendments to the Mine Act to permit assessments against any miner who violates MSHA regulations pertaining to the use of seat belts, safety belts and lines, life jackets, hard hats, or any other form of personal protective equipment that MSHA deems appropriate, as well as proposals to increase maximum assessments against operators.

**MSHA's Response**

Amendment of the Mine Act to assess civil penalties against individual miners, beyond what the Mine Act currently allows, would be an extremely controversial and difficult undertaking, with very little likelihood of success. We could not initiate

congressional consideration of such an amendment without clear and compelling evidence that this would result in fewer injuries to miners. Such evidence does not currently exist, and we strongly urge that the OIG's final report not include amendment of the Mine Act among its recommendations.

We are strongly opposed to initiating amendment of the Mine Act for several reasons. In 1995 there were several congressional attempts to amend the Mine Act to merge MSHA with OSHA and significantly weaken MSHA's statutory enforcement powers. Although these attempts were not successful, any move to reopen the Mine Act would risk inviting further congressional action to reduce our statutory authority, a result which is directly contrary to the OIG's objective in making its recommendation.

An additional reason why amending the Mine Act is not a realistic option is that organized labor would intensely resist any attempts to penalize individual miners for unsafe acts. The most prominent and politically influential of these organizations are the United Mine Workers of America and the United Steelworkers of America, although other smaller labor organizations would likely join in the fight. We foresee that these organizations would violently oppose any efforts to shift responsibility for violations of safety standards from mine operators to individual miners.

As far as enhanced assessments are concerned, we have utilized enhanced assessments for penalties for violations of some health and safety standards. Under our assessments regulations at 30 CFR part 100 and the Mine Act, we can propose an assessment for up to \$55,000 for any single violation, depending on the facts of the violation and the size of the operation. Our policy and §100.5(a)(8) provide that violations that involve "unique aggravating circumstances" may be considered for special assessment. A penalty that results from a special assessment is almost always higher than the penalty generated under the regular assessments formula (thousands of dollars rather than hundreds of dollars).

The Administrator may designate violations of certain safety or health standards for consideration for special assessment. I believe that designating violations issued for failure to use personal protective equipment for special assessment has merit, and we can issue such guidance to Metal and Nonmetal field staff.



**OIG Draft Recommendation #2**

MSHA should pursue technological solutions to combat the problem of miners not using personal protective equipment whenever feasible. These should include regulatory proposals requiring mining vehicles to have additional passive safety equipment deemed appropriate by MSHA, including:

- (1) Ignition lock-out switches which will not allow a vehicle to be started unless the vehicle operator is wearing his seat belt.
- (2) Vehicle sirens which sound in the event that a miner removes his seat belt while the vehicle's engine is running.

**MSHA's Response**

We have given serious consideration to a regulatory requirement for ignition lock-out switches for mobile equipment. We published an Advance Notice of Proposed Rulemaking in the Federal Register on July 30, 1998, concerning safety standards for surface haulage equipment, and solicited public comment on the advisability of requiring such interlock devices. We received extensive negative comment on such a requirement. Some commenters were concerned that such devices would create greater safety problems than they would solve. Specifically, commenters stated that if the interlock device malfunctioned and shut down the equipment it could place miners in an unsafe situation. Additionally, commenters were concerned that interlock devices would make it more difficult to move equipment quickly in the event of an emergency. Commenters also observed that there are sometimes legitimate reasons why an equipment operator might need to release his or her seat belt while the equipment is operating, but that the interlock device would make this impossible. Because of the significant practical problems associated with interlock devices, we do not expect to include an interlock device requirement in the proposed rule. (We understand that Congress has enacted legislation that prohibits the Department of Transportation from promulgating regulations that would require interlock devices in passenger cars, apparently in response to some of the same type of safety concerns expressed by commenters to our ANPRM.)

Although we do not presently intend to propose a requirement that a siren sound when an equipment operator removes his or her seat belt, we are currently considering imposing a requirement that is similar in impact. MSHA's draft proposed rule for safety standards for surface haulage equipment includes a requirement

that equipment manufactured after a certain date be equipped with a light that is labeled "seat belt in use" visible from the front of the equipment at ground level. The light would be on only when the equipment operator is wearing the seat belt.

### *OIG Draft Recommendation #3*

To enhance the effectiveness of its training requirements and mine safety sweeps, MSHA should consider stressing new motivational approaches to prevent risk taking behavior. In this regard, MSHA might consider contracting with certified safety psychologists to develop training programs which focus on risk taking behavior, particularly in the areas of personal protective equipment. For example, safety professionals have addressed employee risk taking behavior by mimicking the fear producing effects of "near hits" in their safety programs.

### *MSHA's Response*

We agree that mandatory training may not always deter risk-taking behavior. We also believe that to eliminate risk-taking behavior on the part of miners, mine operators must insist that miners use personal protective equipment and take action whenever miners fail to use this equipment as directed. MSHA's aggressive enforcement of personal protective equipment requirements can provide an incentive for operators to ensure strict compliance by miners with these requirements.

We have used occupational psychologists in the past to assist in developing training for miners in emergency situations. This training, which was developed at the University of Kentucky under a Bureau of Mines contract, included exercises designed to place the miner in a simulation of a real-life situation.

Additionally, MSHA has worked with mine operators in developing training material based on "near hits." One video developed by MSHA concerns an off-the-road truck that lost its power and brakes and went down a mountain backward. The wreck completely destroyed the truck, but the driver states that he is alive because he was wearing his seat belt. Another video produced by MSHA involves a bulldozer operator who survived a fall from a highwall while buckled in with his seat belt. These videos include extensive first-person interviews with the miners involved in the accidents.

As indicated, we are open to working with occupational psychologists in appropriate situations. We will give serious consideration to this recommendation.

U.S. Department of Labor

Mine Safety and Health Administration  
4015 Wilson Boulevard  
Arlington, Virginia 22203-1984

April 21, 2000

MEMORANDUM FOR JOSE M. RALLS  
Acting Assistant Inspector General for  
Analysis, Complaints, and EvaluationsFROM: J. DAVITT McATEER  
Assistant Secretary for  
Mine Safety and Health

A handwritten signature in black ink, appearing to read "J. Davitt McAteer". The signature is written over the typed name and title of the sender.

SUBJECT: Review of Fatal Accidents in Metal  
and Nonmetal Mining 1995-1998  
Report No. 2E-06-001-0004

By memorandum dated April 12, 2000, you forwarded to us the draft report by the Office of Inspector General (OIG) of a study of factors that influence fatal accidents in the metal and nonmetal sector of the mining industry. The draft report contains the findings, conclusions, and recommendations resulting from that study. We have reviewed the draft report, and have included our comments on the methodology and conclusions of the draft report. We also have provided our responses to the specific recommendations in the report.

### **Background**

Beginning in 1997, MSHA became greatly concerned with a sudden upward trend in fatal accidents. The 50 fatalities that occurred by September 1997 surpassed the total of 47 fatalities for the entire 1996 calendar year as well as the record-low of 40 for 1994. At the direction of the Assistant Secretary, the agency developed several initiatives to respond to the situation, which included having each Metal and Nonmetal District develop its own "Fatality Reduction Plan." The Assistant Secretary also gathered representatives of industry and labor that year to address this dramatic increase in fatalities. In 1998, Metal and Nonmetal unified the district plans and incorporated many of the strategies into a single statement of Metal and Nonmetal Mine Safety and Health's priorities.

Since October 1998, Metal and Nonmetal has sponsored or participated in more than 40 safety and health seminars tailored to the needs of independent contractors, whose employees

typically are involved disproportionately in mining accidents. The seminars, which have been held at locations throughout the country have attracted more than 1,000 mining industry and independent contractor employees.

Additionally, in May 1999, Metal and Nonmetal Mine Safety and Health conducted a safety initiative to raise awareness among small surface mine operators of the hazards associated with their mining operations. This initiative targeted 5,000 smaller metal and nonmetal surface mines, typically sand and gravel operations, a sector of the industry which suffered a disproportionate share of fatal accidents.

Under this initiative, Metal and Nonmetal inspectors visited mines with fewer than five employees and conducted regular inspections, including safety talks as part of their inspections. These talks addressed unsafe conditions and work practices that contributed to recent injuries and fatalities at small operations; recurring health hazards at small mines; and safety and health tips that can prevent the most common serious and fatal injuries at these mines.

In October 1999, after a recent spike in fatalities over a short period of time, Metal and Nonmetal implemented another fatality reduction initiative. Metal and Nonmetal, in coordination with Technical Support and the Educational Field Services (EFS) staff of Educational Policy Development, conducted an extensive nationwide outreach program to inform both miners and mine operators of the increase in fatalities, causes of fatalities, and steps to be taken to prevent them. Metal and Nonmetal Supervisory personnel contacted the mines within their jurisdiction to heighten awareness of this initiative. Inspectors talked to both miners and mine operators during their regular inspections about the rise in fatalities and causes. Agency inspectors and EFS staff talked with more than 11,500 miners.

These initiatives have had a positive impact on the number of fatal accidents in metal and nonmetal mines: In 1998 there were 51 fatal accidents, and in 1999, there were 54. So far this year there have been 12 fatal accidents, compared to 21 at the same time in 1997; 16 in 1998; and 16 in 1999.

MSHA efforts to address the fatalities also came to the attention of the OIG. The OIG initiated its review to assist MSHA in analyzing factors that play a part in fatal accidents at metal and nonmetal mines. This review was apparently prompted, at

least in part, by the 61 fatal accidents at metal and nonmetal mines in 1997, a 10-year high.

### ***MSHA's Comments on the Report Methodology***

The stated purpose of the OIG report is "...to assist MSHA in their analysis of factors which influence fatal accidents in the metal and nonmetal sector of the mining industry." Noting that MSHA analyzes many factors in order to determine the causes of accidents, the OIG decided to instead focus "...on factors contributing to fatal accidents not fully stressed by MSHA, or stressed fully in relationship to other variables."

MSHA questions the merit of this methodological technique. By design, the analysis overemphasizes one factor, to the exclusion of other more significant factors.

The methodology section of the report also states "A review of research regarding occupational and accidental deaths was also conducted to explore the applicability of factors which may influence fatal accidents in the mining industry." The report authors include a bibliographical note which indicates the narrow scope of the research: "...our bibliography provides an overview of the issues surrounding cognitive/behavioral safety training, in addition to detailed information on risk-taking behavior and workplace accidents."

The reports authors did not consider the broader body of occupational safety and health research and analysis which has developed over the past 50 years. A fundamental and well-accepted principle of occupational safety and health is the 3-tiered hierarchy of accident prevention and control. The hierarchy is engineering controls, administrative controls, and personal protective equipment (PPE), with engineering controls recognized as the first line of defense to prevent workplace injuries and illnesses. This hierarchy has been adopted by MSHA, OSHA and other occupational safety and health agencies in the United States and around the world.

In addition, the report authors appear to neglect or ignore the studies of inadequate corporate safety and health programs, and the successes and failures of various corporate approaches.

This single-minded approach is overly simplistic and, consequently, flawed. The analysis focuses on only one part of the complex process of worker safety and accident prevention. By focusing on personal protective equipment and "risk-taking"

behavior, there is an implication that the miner is mostly to blame for fatal accidents. In reality, most failures that result in mining fatalities are system failures. They may be failures in the haulage systems, the communications systems, etc. The failures typically occur because either the system was not designed properly, the worker did not understand the system, there was a conscious decision not to take the proper action on the part of management or the employer, or a mechanical failure occurred. The limited focus on personal protective equipment and behavior ignores all other causative factors.

### **MSHA's Comments on the Report's Data Analysis**

The data analysis conducted for the report demonstrates the fallacy of examining "causes" or "contributing factors" out of context. In attempting to link a miner's failure to use PPE and a fatal accident, the OIG disregards critical facts that negate the PPE factor. For example, the report refers to an accident where a miner was "struck in head by large tire" and mentions a "hard hat" as the relevant PPE. The facts of the case are:

*The victim was working beneath a 2,660 lb. tire that was suspended from a crane. The shop-fabricated bead hook from which the tire was suspended did not secure the tire from falling while it was being lifted and moved. The victim's head and neck were crushed under the tire. While the victim was not wearing a hard hat to prevent head injuries (MSHA cited this failure), the protection afforded by a hard hat against the weight of the tire would not have prevented the employee's death.*

In another example, the report refers to an accident where the victim fell from a ladder and his safety line was too long and it mentions "safety belt/line" as the relevant PPE. The facts of the case are:

*A miner had entered a bin wearing a safety belt, lanyard and lifeline. He had tied off on the walkway and had entered the bin. A second miner was assigned to attend the lifeline. During the cleanout procedure the victim fell during a time when the man assigned to the lifeline was distracted and had left his position. The line was too long and allowed the victim to be engulfed in the material within the bin. All PPE was worn, though improperly adjusted. Procedure was violated when*

*the lifeline attendant left his post. This was not a failure to wear PPE, but a deficiency in training.*

These are just two examples (please see attachment for further analysis) of how simplistic analyses can distort conclusions and lead to fruitless recommendations. MSHA believes that constructive analysis must examine all conditions, systems and behaviors that are relevant to the accident. We cannot forget that we are investigating human behavior—neither workers or managers are robots and most do not deliberately engage in unsafe acts. If we want to continue making progress reducing workplace injuries and illnesses, we need a better appreciation and understanding of all of the factors that lead or cause us to behave as we do—management styles, production pressures, workplace environment, etc. etc., etc.

#### ***MSHA's Comments on the Report Findings***

The report states that failure to utilize personal protective equipment is a significant factor in fatalities in metal and nonmetal mines. The report states that failure to use PPE does not necessarily cause fatal accidents but the report provides no estimate of how many fatalities would have been prevented through the use of such equipment.

In fact, failure to use PPE rarely **causes** an accident. As is correctly noted in the OIG report, PPE can be a major factor in the severity of an accident. However, the most PPE can do is protect the worker in case of one of the system failures noted above.

This is an extremely important distinction. It is MSHA's position, as well as the other agencies responsible for occupational safety and health, that the best way to reduce accidents and injuries is to prevent their occurrence by **eliminating the causes**. Personal protective equipment is integral to an effective safety and health program; but it is critical to make clear the Agency's position is and will continue to be that MSHA will, first and foremost, continue to focus our efforts on **accident prevention**. As the record for accident reduction indicates, accident prevention has allowed the U.S. to become the world's leader in mine safety.

Additionally, the report suggests that safety training may not prevent risk-taking by miners, pointing to the fact that miners were killed while working at mines where training was "often" provided. However, in over half of the fatal accidents cited in the OIG report, there was no indication that the victim received any safety training whatsoever. Further, no qualitative evaluation was made of the training that the other victims received. Without such information, it is difficult to conclude that such training is ineffective in deterring risk-taking behavior.

#### ***OIG Recommendation #1***

**Utilize certified occupational/safety psychologists to develop training and educational programs which specifically target risk-taking behavior and PPE [personal protective equipment] use. The training should be developed as an ongoing process to provide consistent reinforcement to miners, and assimilated within MSHA's current training methods.**

#### ***MSHA's Response***

Behavioral psychologists have, in the recent past, presented to the safety and health community some insight into accident causation. When their analysis looks at the complete accident cause, including the system failures and individuals' behavior (both management and labor) constructively, then their efforts have been of some help.

However, the OIG has presented no evidence that establishes that training and educational programs developed by occupational or safety psychologists are more effective than programs developed by other professionals in deterring risk-taking behavior or encouraging PPE use-especially when, as in this matter, the efforts focus only on the behavior of one aspect of presenting the review.

Representatives from MSHA's Directorate of Educational Policy and Development recently met to discuss addressing miner training needs with representatives from the National Institute for Occupational Safety and Health (NIOSH). We are exploring with NIOSH ways in which we might use occupational psychologists in developing training programs designed to reduce risk-taking behavior and encourage the use of PPE on the part of both management as well as labor. The report's narrow focus on employee behavior fails to recognize the risk-taking behavior of top and middle management, and does not address one of the main



requirements of effective training programs: a steadfast, unyielding commitment to safety at all levels from top management on down.

There is no consensus among professionals in the field of occupational psychology on the type of training best suited to altering risk-taking behavior. It appears likely that significant research remains to be done in this area before effective training programs will be developed. The professional safety and health community views with skepticism the use of behavioral controls. If it is used in a broad-based context for both management and labor it has limited usefulness. If, however, it is used as this report reasons, it could well result in a prejudicial outcome. The effect would be to blame the victim, a concept which should be rejected in the final years of the 20<sup>th</sup> century.

The OIG should be aware that MSHA has no authority to require mine operators to use any training programs that MSHA may develop in response to this recommendation. Although mine operators are required by MSHA regulations to provide specific health and safety training to miners, there is nothing in either the Mine Act or the regulations which mandates that mine operators use MSHA-developed training programs.

Mine operators are free to develop their own training in-house or arrange with State agencies or private contractors for required miner training to be provided. In either case, there must be commitment from company management for any of this training to be effective. This would also hold true for any behavior-based training MSHA develops.

#### **OIG Recommendation #2**

**Review whether special and regular assessments for PPE violations can be pursued more effectively, particularly in situations where a mine operator has demonstrated past PPE compliance problems.**

#### **MSHA Response**

MSHA utilizes enhanced assessments for penalties for violations of some health and safety standards. Under our assessments regulations specified in 30 CFR part 100 and the Mine Act, we can propose an assessment of up to \$55,000 for any single violation, depending on the facts of the violation and the size of the operation. Our policy and §100.5(a)(8) provide that violations that involve "unique aggravating circumstances" may be considered for special assessment. A penalty that results from a special

assessment is almost always higher than the penalty generated under the regular assessments formula (thousands of dollars rather than hundreds of dollars).

The Administrator may designate violations of certain safety or health standards for consideration for special assessment. We are in the process of developing a memorandum that directs both Metal and Nonmetal and Coal District Managers to review for special assessments all violations issued for failure to use personal protective equipment.

### ***OIG Recommendation #3***

**Pursue engineering controls, to combat the problem of miners not using PPE and enhance PPE effectiveness, whenever feasible. These should include regulatory proposals requiring mining vehicles to have additional passive safety equipment, including, but not necessarily limited to:**

- a. **Warning devices, e.g., lights, buzzers and/or sirens, which would serve both to remind the occupants, as well as alert an observer, if a vehicle occupant removes a seat belts/restraint system while the vehicle's engine is running.**
- b. **Requirements for all mine vehicles to have restraint systems for the lower torso (seat belts) for both equipment operators and passengers, whether or not the vehicle has Roll Over Protective Structures (ROPS).**
- c. **Requirements that all newly manufactured mine vehicles have both lower torso (e.g., lap belt) and upper torso restraint systems (e.g., harness or equivalent). A possible exception would be highway trucks regulated by the U.S. Department of Transportation.**

### ***MSHA's Response***

MSHA began its review of seat belt use and warning lights for surface haulage vehicles as a result of initial analysis of these types of accidents in 1994. As a result of these studies, a regulatory plan was published in the Federal Register in 1995.

MSHA published an Advance Notice of Proposed Rulemaking in the Federal Register on July 30, 1998, concerning safety standards for surface haulage equipment. MSHA examined approximately 8,000 surface accidents (from 1987 to 1996) involving powered haulage

equipment which resulted in either fatalities or lost work days. During that time, 120 miners were killed and 1,377 were injured due to three causes or contributing factors: unused or inadequate occupant restraint systems on the equipment; blind areas on self-propelled mobile equipment; and lack of adequate illumination. MSHA is in the process of developing a proposed rule that would include requirements for surface haulage equipment in three specific areas: illumination; restraint systems; and blind areas. MSHA anticipates publication of this proposal in July.

MSHA currently intends to propose requirements that would require a "seat belt in use" light outside the equipment cab to indicate whether an equipment operator is wearing the seat belt. It has been our experience that positive reinforcement devices such as the "seat belt in use" light are more likely to be accepted by the employees than negative reinforcement devices such as a bell or siren. Additionally, for equipment having an obstructed view to the rear, if the mobile equipment uses a discriminating warning device to detect objects or persons at the rear of the equipment, we propose to require audible or visual alarms inside the cab to alert the vehicle operator of persons or objects detected in the sensing area. We are reserving audible alarms for this unique purpose.

The current draft of the proposed rule would require that most existing equipment (both ROPS and non-ROPS equipment) be equipped with two-point seat belts. Although we considered requiring four-point seat belts on all new equipment, we concluded that four-point seat belts impose limitations on upper body mobility that could create safety hazards for operators of some types of equipment. For example, some equipment operators pivot to see through side windows or turn around to see through back windows rather than use mirrors while backing equipment. If too constrained by four-point seat belts to pivot or turn, equipment operators might miss side or back views essential to steer equipment or attachments clear of nearby people, equipment, and other objects.

Obviously, we cannot guarantee which requirements will ultimately be incorporated into the final rule. The public will have the opportunity to comment on the proposed rule once it is published in the Federal Register, and we will carefully consider all of the comments we receive in developing the final rule.

#### **OIG Recommendation #4**

**Over a five-year period, calendar years 2000 through 2004, MSHA should track and monitor the number of miners killed while not**

using PPE to evaluate the effectiveness of recommendations 1, 2, and 3, or any other measures deemed appropriate by MSHA to increase PPE use by miners. However, after this period, if PPE related fatalities have not significantly declined, MSHA should examine other options, such as individual assessments against any miner for PPE violations, to increase PPE use.

For tracking purposes, MSHA must ensure that every fatal accident investigation report address miner use of PPE in all applicable fatalities (vehicular accidents, falls, drownings, head injuries, etc.). For monitoring purposes, MSHA should establish a separate section on its Web page that lists all fatalities where failure to use PPE was a contributing factor. In addition to tracking fatalities, an additional method of measuring the level of PPE use among miners could be to track serious injuries each year where failure to use PPE was a factor.

#### ***MSHA's Response***

MSHA's accident investigators examine the use of PPE and have done so for many years. MSHA will continue to examine this and all relevant factors in its investigations and include this information in its written reports and educational materials. On an ongoing basis, MSHA closely examines its full range of data to better focus its enforcement, educational and regulatory programs. This includes tracking a myriad of factors that relate to, contribute to, or are somehow related to injuries, illnesses and fatalities in mining.

We strongly disagree with the OIG's recommendation to leave open the option of assessing monetary penalties against miners who violate PPE regulations. With this recommendation, the OIG disregards the fundamental principal established in the Occupational Safety and Health Act of 1970 and the Federal Mine Safety and Health Act of 1977. These laws recognize that employers, not workers, have control over their workplace and, therefore, have primary responsibility for ensuring that workplaces are safe and healthful. We urge the OIG to delete this recommendation from the final report.

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Attachment

**Number in OIG Report: 03**

Equipment Involved: Seat Belt

OIG Description: Miner flipped vehicle. Vehicle manufactured before ROPS and seat belts were required.

MSHA Conclusion: The victim was operating a Michigan 175 III A front-end loader, Serial Number 10 AHG130, manufactured in 1968. It was equipped with a 5-yard capacity bucket and an operator's cab, but was not provided with a rollover protective structure (ROPS) or a seat belt. MSHA regulation (56.14130) requires that wheeled loaders, such as the one involved in this accident, have ROPS and seat belts if manufactured on or after July 1, 1969.

**Number in OIG Report: 04**

Equipment Involved: Seat Belt Related?

OIG Description: Miner stood up and fell from moving vehicle. Run over. Task training provided.

MSHA Conclusion: The direct cause of the accident could not be determined because no one witnessed the action which initiated the event. The investigation revealed that the most likely sequence of events was as follows: The victim shifted the directional lever to the neutral position and stopped the motion of the dozer. He then attempted to climb out of the operator's compartment. He slipped on the dozer's left track simultaneously striking the directional lever and pushed it into the reverse position. At the time, the dozer's transmission was in second gear at 3/4 throttle which caused the dozer to reverse at a fast speed. Due to the speed of the track reversing, the victim could not regain his balance and was caught and carried away by the fast moving track. Possible contributing factors were the nonfunctioning directional lever neutral lock, missing track segments, and the minimal training and experience of the victim in the task he was performing. Seat belts would not have prevented this accident since the victim was attempting to climb off of the equipment.

**Number in OIG Report: 08**

Equipment Involved: Safety line/belt

OIG Description: Miner fell 35 feet after hit by falling debris.

MSHA Conclusion: The victim was working in a quarry on a ledge which was level and approximately 26 feet wide by 30 feet long. A 40-foot steel ladder placed on the ledge below extended 6 feet above the ledge where the victim was standing and slid about 2 feet toward the victim when a rock being hoisted by a crane fell and struck the ladder which in turn knocked the victim off the ledge. There was no place on the ledge for the miner to tie off nor was a citation issued for safety belts and lines, 56.15005.

**Number in OIG Report:13**

OIG Description: Miner struck in head by sheet metal

Equipment Involved: Hard Hat

MSHA Conclusion: Three sheets of steel weighing 5,875 pounds struck the victim on the head while they were being unloaded from a truck. While failure to use protective head wear may have contributed to the severity of the accident, hard hats are not constructed to withstand 5,875 pounds of pressure.

**Number in OIG Report:15**

Equipment Involved: Seat Belts

OIG Description: Miner fell off vehicle during instruction -no seat belt available.

MSHA Conclusion: A loader operator stopped the victim at the feeder area so he could give him some pointers on digging on an incline with the front-end loader. He climbed into the operator's seat and drove the loader to the stockpile while the victim sat in the doorway with his legs hanging out over the edge of the deck. The trainer filled the bucket, reversed the loader, and began to back in a semi-circle to the right. The loader traveled about thirty feet before running over something that jolted it. The trainer looked to the front of the loader and saw the victim fall. He stopped the vehicle and started to dismount to check on him. He could see that the victim was under the left front wheel and he moved the loader forward. The reason the victim was fatally injured was because he was riding unsecured on the outside of the cab.

**Number in OIG Report:17**

Equipment Involved: Seat Belt Related

OIG Description: Miner stood up while vehicle was in operation, crushed. Task and orientation training provided.

MSHA Conclusion: The victim was fatally injured when he was crushed between the lift arm and the roll-over protective structure (ROPS) of a small utility loader. The primary cause of the accident was the failure to maintain control of the loader while it was running. A contributing factor was the lack of an automatic safety device to prevent movement of the bucket and arms when the operator gets out of the seat. Newer units are provided with bars that swing down over the operator's lap or have a sensor in the seat. A seat belt was provided and sized for use by this operator and was not cited as a contributing factor.

**Number in OIG Report:18**

Equipment Involved: Seat Belt Related

OIG Description: Miner thrown from vehicle while in operation and run over.

MSHA Conclusion: The loader the victim had been operating was seen going down the drift at a high rate of speed. As the loader continued backward down the slope it gained momentum and the victim was unable to stop or control the loader. Damage to the loader and scrape marks in the gallery drift indicated that the loader struck both ribs while descending approximately 600 feet before stopping. Lack of control or impact with the rib either caused the victim to jump or be thrown from the loader. When the loader stopped it was found that the transmission was in neutral and the park brake set. The brake pedal was found in the gallery drift 11 feet from the victim and 213 feet from the loader. There is no standard requiring that equipment used in underground operations have seat belts.

**Number in OIG Report: 25**

Equipment Involved: Safety line/belt

OIG Description: Miner fell 25 feet from scaffold. Company had conducted training on safety belt/line use.

MSHA Conclusion: Two employees were fatally injured when hot, raw material inundated the kiln and clinker cooler area of the mill. The victims were working on a temporary work platform and were trying to escape the 900 centigrade dust when one victim either fell or jumped off the platform to the ground 25 feet below. The other victim climbed down from the platform and collapsed onto the floor. While neither victim was wearing a safety belt/line, given the circumstances, if they had been wearing belts they would have unhooked them to escape the situation at that moment.

**Number in OIG Report: 30**

Equipment Involved: Seatbelt

OIG Description: Miner left seat (seat belt was tucked behind seat) and was pinned via lift arm and canopy. PPE training unclear.

MSHA Conclusion: The victim was operating a skid-steer loader using a hoe attachment when the hoe attachment partially disengaged from the loader. The victim raised the safety seat-bar and leaned out of the cab, leaving the operator's seat, and reached for the lift boom arm to reset the latching device. His foot contacted the foot pedal, causing the boom to raise, pinning him between the cross member of the boom and the canopy of the cab. The victim bypassed the seat safety bar which would have rendered the hydraulic system, including the tramming functions, inoperational. The employees at this operation were not indoctrinated in safety rules and safe work procedures when hired.

**Number in OIG Report: 33**

Equipment Involved: Seat Belt

OIG Description: Foreman's truck flipped - Victim's body configuration in cab strongly suggests that seat belt was not worn.

MSHA Conclusion: The victim was driving a truck traveling about 5 miles an hour on an unbermed mountain road. There was one other passenger in the vehicle. The truck drifted to the edge of the road and went over the side of the road. The truck overturned at least twice, rolling about 70 feet down a mountain, where it stopped on the switchback roadway below. It is unknown whether the victim was wearing his seat belt, but the single passenger in the truck unfastened his seat belt and attempted to exit the cab just prior to the final impact. The force of the vehicle striking the roadway threw the passenger out of the side window. The passenger survived, the driver died.

**Number in OIG Report: 37**

Equipment Involved: Safety belt and line

OIG Description: Mine agent fell down 46 foot hole after premature detonation.

MSHA Conclusion: Two miners were dislodging a hung stick of dynamite when it prematurely detonated setting off several additional cartridges of high explosive further down the hole. The blast sent one miner over a highwall and severely injured the other. The primary cause of the accident was improper blasting procedures. The failure to wear a safety belt and line while working where there was a danger of falling may have contributed to the severity of the accident but was secondary to the nature of the accident.

**Number in OIG Report: 43**



Equipment Involved: Life Jacket  
OIG Description: Miner fell from boat and drowned. Usable life jacket found in boat.

MSHA Conclusion: There were no witnesses to this accident. The victim's body was found by searching divers in water about 50 feet deep, and 20 to 30 feet from the dredge on which the victim was working. The Medical Examiner found no water in the victim's lungs. The Medical Examiner listed the cause of death as cardiac arrhythmia due to hypertensive cardiovascular disease and listed blunt force trauma to the head with facial contusions as other significant conditions contributing to the death but not related to the underlying cause.

**Number in OIG Report: 44**  
Equipment Involved: Hard hat  
OIG Description: Miner struck in head by large tire.

MSHA Conclusion: The victim was working beneath a 2,660 lb. tire that was suspended from a crane. The shop-fabricated bead hook from which the tire was suspended did not secure the tire from falling while it was being lifted and moved. The victim's head and neck were crushed under the tire. While the victim was not wearing a hard hat to prevent head injuries, the protection afforded by a hard hat against the weight of the tire would not have prevented the employee's death.

**Number in OIG Report: 45**  
Equipment Involved: Hard Hat  
OIG Description: Miner struck in head by fender of front end loader.

MSHA Conclusion: A 450 lb front end loader (FEL) fender fell on a mechanic as he was crawling out from under the loader. Allowing employees to work under suspended loads and the failure to properly secure the raised FEL fender before working under it, were the direct causes of the accident. The use of a defective portable ratchet hoist contributed to the cause of the accident. While failure to use protective head wear may have contributed to the severity of the accident, hard hats are not constructed to withstand the impact of a falling 450 lb object. Hard hats are constructed to withstand the equivalent of an 8 lb. steel ball falling 5 ft and striking within a 3 inch circle on top of the helmet.

**Number in OIG Report: 46**  
Equipment Involved: Hard Hat  
OIG Description: Miner-operator struck in head by locomotive truck wheel.

MSHA Conclusion: An 18 ton locomotive wheel truck assembly fell on a mechanic while he was lying under the assembly performing maintenance work. Allowing employees to work under suspended loads and the failure to properly secure the raised truck assembly from accidental lowering before working under it, were the direct causes of the accident. While failure to use protective head wear may have contributed to the severity of the accident, hard hats are not constructed to withstand 18 tons of pressure. Hard hats are generally constructed to withstand the equivalent of an 8 lb. steel ball falling 5 ft and striking within a 3 inch circle on

**Number in OIG Report: 50**

Equipment Involved: Seat Belt  
OIG Description: Intoxicated miners' trailer jack-knifed. Blood alcohol of .02 - Fatalgram indicates that seatbelt was not used.

MSHA Conclusion: The victim was driving a truck towing a trailer on a stockpile. The truck and trailer were not designed to be used together. While making a U-turn, the victim turned to the left and the right rear tractor tire dropped about 18 inches due to the uneven surface of the stockpile. When the right rear tire dropped, the left rear tire raised, pinching the left rear fender of the truck between the tire and the tongue of the tractor and trailer. The fender was pushed into the rear of the operator's compartment, crushing the victim against the steering wheel and windshield. The victim would have been crushed regardless of whether he was using his

**Number in OIG Report: 52**

Equipment Involved: Seat Belt  
OIG Description: Miner killed in collision with another vehicle.

MSHA Conclusion: The victim was driving a 1-ton service truck and had stopped prior to entering the intersection. He then entered the intersection with his lights off (it was after sunset) and was run over by an approaching 190 ton haul truck. The truck became lodged and caught fire underneath the haul truck. The victim was pinned between the dashboard and the deformed cab of the service truck. Although wearing a seat belt is strongly recommended, it is unclear what part they would have played in this accident. Further, there is no statutory requirement for the use of seat belts in this type of equipment and no citation was issued failure to wear seat belts.

**Number in OIG Report: 57**

Equipment Involved: Safety line/Hardhat  
OIG Description: Intoxicated independent truck driver fell from truck - fatal skull fracture. PPE was not discussed in report.

MSHA Conclusion: The victim sustained a skull fracture from an apparent fall from an unknown location. There was no apparent reason for him to climb onto the truck or handrail. Hard hats are intended for protection from falling objects, not as fall protection. It is highly dubious that wearing a hard hat would have prevented this accident. The use of a safety belt and line is conjecture because it is unknown from where the victim fell.

**Number in OIG Report: 62**

Equipment Involved: Safety line/belt  
OIG Description: Miner fall unchecked by use of safety line.

MSHA Conclusion: A miner had entered a bin wearing a safety belt, lanyard and lifeline. He had tied off on the walkway and had entered the bin. A second miner was assigned to attend the lifeline. During the cleanout procedure the victim fell during a time when the man assigned to the lifeline was distracted and had left his position. The line was too long and allowed the victim to be engulfed in the material within the bin. All PPE was worn, though improperly adjusted. Procedure was violated when the lifeline attendant left his post. This was not a failure to wear PPE, but a deficiency in training.

**Number in OIG Report: 64**

Equipment Involved: Hard Hat

OIG Description: Miner struck in head by sledge hammer.

MSHA Conclusion: This is the same accident as identified in number 55 and was counted twice.

**Number in OIG Report: 65**

Equipment Involved: Life Jacket

OIG Description: Miner drowned after pump station capsized. Working where there was danger of falling into water.

MSHA Conclusion: Two men were assigned to install a guard on a V-belt drive in a floating pump house. Their foremen took the opportunity to take the welder out to the pump house and explain the facility to him. As the fourth person entered the pump house it began to tip and water entered the house. The men retreated in reverse order and, because the floating walkway had drifted off, jumped into the below waist deep water. The last person off, the victim, was caught under the capsizing pump house and was forced underwater as he was exiting. Life jackets were not cited in this accident and would not have helped to prevent the victim from being pushed underwater by the pump house.

**Number in OIG Report: 66**

Equipment Involved: Gloves

OIG Description: Mine superintendant [sic] hand came in contact with damaged cable - insulated gloves not worn (Fatalgram)

MSHA Conclusion: The direct cause of the accident was the poor condition of the trailing cable and failure to repair the damaged part before it was energized. A contributing factor was failure to protect the cable against mechanical damage. The cable had been moved and positioned while de-energized, and therefore did not require gloves. At the time of the accident no one was handling the cable, although the victim was checking the cable for bad spots. The investigators did not find that a violation existed where insulating gloves were required. Although they may have prevented this accident, there was apparently no requirement for their use.