



HHS Public Access

Author manuscript

Trans Soc Min Metall Explor Inc. Author manuscript; available in PMC 2017 June 19.

Published in final edited form as:

Trans Soc Min Metall Explor Inc. 2016 ; 340(1): 100–103. doi:10.19150/trans.7333.

Managing health and safety risks: Implications for tailoring health and safety management system practices

D.R. Willmer and E.J. Haas

Ph.D. and Ph.D, respectively, Pittsburgh Mining Research Division, National Institute for Occupational Safety and Health (NIOSH PMRD), Pittsburgh, PA, USA

Abstract

As national and international health and safety management system (HSMS) standards are voluntarily accepted or regulated into practice, organizations are making an effort to modify and integrate strategic elements of a connected management system into their daily risk management practices. In high-risk industries such as mining, that effort takes on added importance. The mining industry has long recognized the importance of a more integrated approach to recognizing and responding to site-specific risks, encouraging the adoption of a risk-based management framework. Recently, the U.S. National Mining Association led the development of an industry-specific HSMS built on the strategic frameworks of ANSI: Z10, OHSAS 18001, The American Chemistry Council's Responsible Care, and ILO-OSH 2001. All of these standards provide strategic guidance and focus on how to incorporate a plan-do-check-act cycle into the identification, management and evaluation of worksite risks. This paper details an exploratory study into whether practices associated with executing a risk-based management framework are visible through the actions of an organization's site-level management of health and safety risks. The results of this study show ways that site-level leaders manage day-to-day risk at their operations that can be characterized according to practices associated with a risk-based management framework. Having tangible operational examples of day-to-day risk management can serve as a starting point for evaluating field-level risk assessment efforts and their alignment to overall company efforts at effective risk mitigation through a HSMS or other processes.

Keywords

Health and safety management systems; Risk management; Operations

Introduction

With interest growing in determining the effectiveness of health and safety management systems (HSMS) in reducing worksite injuries, illnesses and fatalities, there is a rich vein of knowledge available for studying how such a system operates on the front lines of an

Corresponding author: DWillmer@cdc.gov.

Disclaimer

The findings and conclusions in this paper are those of the authors and do not necessarily represent the views of NIOSH. Mention of company names or products does not constitute endorsement by the Centers for Disease Control and Prevention.

organization. To varying degrees of specificity, current HSMS standards offer examples to help inform the development and planning of such systems and then guide the implementation of the plan-do-check-act (PDCA) cycle. Regarding HSMS planning, Yorio and Willmer (2015) used the U.S. National Mining Association (NMA)-led CORESafety framework to capture the perspectives of strategic and operations-level mining industry representatives on the fundamental HSMS elements needed for an effective risk-based HSMS, providing detailed examples of day-to-day operational practices in the industry and how leaders effectively manage those risks on site. However, knowledge gaps still exist, and determining practical approaches for how to best design and manage effective systems require more attention. Generally, guidance on the ways to implement an HSMS through everyday practices is limited (Yorio, Willmer and Moore, 2015; Rost, Willmer and Haas, 2015).

Methods

We used the Sentinels of Safety Award to identify companies that might exhibit best practices in terms of managing health and safety risks. This award is the oldest established award for occupational safety, and the award program is now evaluated exclusively by the NMA. The award “recognize(s) achievement of outstanding safety performance, to stimulate greater interest in safety and to encourage development of more effective accident prevention programs among the nation’s mineral (coal, metal and non-metal, stone, sand and gravel) mining operations” (NMA, 2014).

We identified 24 mine operations that received this award at least three times from 2005 through 2010. As multiyear site recipients, we inferred that these operations had some sort of established and consistent process or system for managing safety performance. We used this criterion for the sample and study participation to garner additional validity and reliability of leaders’ responses. Purposive sampling was used to recruit mine leaders from this sample of 24 mines through phone and email communications, securing participation from 25 percent of the sample (Babbie, 1998). These site leaders were in occupations such as site-level safety supervisor, mine superintendent and general manager at surface and underground stone, sand and gravel and metal-non-metal mine sites throughout the United States with employee populations of 40 to 175. Six interviews were completed with mining companies, at which point we started to hear recurring themes among leaders, indicating saturation of content (Corbin and Strauss, 2015).

A moderately structured interview protocol was developed and used to understand the empirically defined indicators of an effective HSMS (Bennet and Foster, 2005). Table 1 lists these indicators and an example interview question for each indicator.

The interview protocol was designed so participating leaders from each mine could discuss their organizational behaviors and practices associated with systematically managing health and safety at the mine site. The interview protocol was approved by the U.S. National Institute for Occupational Safety and Health’s (NIOSH) Institutional Review Board.

We analyzed the interviews for examples of how organizational health and safety (H&S) leaders managed risk at their respective sites. Because the H&S leaders were from mining organizations, we used the NMA's CORESafety HSMS framework to organize the participants' examples of risk management practices. CORESafety contains a risk management element to help mine operations consistently identify hazards and risks related to their specific environment, tasks, jobs and processes (Watzman, 2014). The risk management element contains nine practices deemed essential for H&S managers to promote at their sites (Table 2). We used these nine practices as "codes" to analyze the interview data systematically through both an initial and a focused coding effort (Boyatzis, 1998).

The six interviews provided 450 pages of transcribed data to analyze. We deductively coded the interview data, looking for descriptions of the nine CORESafety risk management practices. In addition, we inductively coded the data, looking for explanatory themes and patterns (Denzin and Lincoln, 2011). Inter-rater reliability of the coded data found agreement of approximately 88 percent, meaning with very high frequency we noted identical risk management practices and themes within the transcripts. This is an acceptable level of agreement between coders for qualitative research (Armstrong et al., 1997; Landis and Koch, 1977).

Results

The coding analysis of the interview transcripts produced the results listed in Table 2. The site leaders' examples aligned most frequently with the following practices: employee involvement in hazard identification, manager-conducted H&S job observations, and manager verification of controls. Those were the most commonly occurring aspects of their daily management of site-level risks.

While these quantitative results provide explanations of "what" and "how often" risk management practices were conducted by health and safety leaders at these mine sites, qualitative analysis of their insights capture the "why" and "in what ways" they manage daily site risks. By characterizing their insights for analytical themes and patterns these insights also offer tangible implementation and operational examples of day-to-day risk management and can serve as a starting point for evaluating field-level risk assessment efforts and their alignment to overall company efforts at effective risk mitigation. Four themes were identified:

Informal employee contribution to hazard identification process

Although formal processes for employee contributions were noted in the interviews, there were many examples across the six organizations of employees engaging in daily hazard identification through informal processes. Leaders described various ways that employees informally contribute to hazard identification efforts "on the spot," in discrete ways, or through encouraging two-way communication with leadership. Some of these scenarios are represented in the following quote: "And I've had people approach me say, 'Hey we need to talk to this guy or we need to look at this a little closer.' I mean, now our guys will come to

me and they'll pull me to the side or they'll do it discreetly, they don't want to cause problems, but they'll bring it to our attention.”

Whether participating in a formal or informal capacity, leaders believed that their employees appreciate being involved in identifying and mitigating site-specific hazards. For instance, one participant reflected, “I've seen it time and time again—the more input you get from the guy who's actually doing the work—One, it's appreciated by them—they'll tell you flat out, Hey thanks for including me and secondly the buy-in is unreal. I mean, they own it.”

Dual purpose of job observations: teaching and operational changes

When coding the data for H&S job observations, two main themes emerged: (1) H&S observations that serve as an opportunity to teach employees about health and safety; and (2) H&S observations that identify potential operational changes that influence site-level risks. In terms of H&S observations that serve to teach employees about H&S, participants emphasized that these observations tended to be unplanned, and they often notice potential hazards as they are “out and about” the mine site and use these opportunities to communicate about and further instill H&S skills. For example, one participant said: “If I drive through the yard I'm watching. If I'm coming up on a guy I'm listening for his back-up alarm, I'm watching to see if he's going to turn his head or what. If he doesn't turn his head I'm going to stop and go talk to him, say something to him.”

Additionally, participants discussed ways they may debrief these observations with groups, rather than just an individual, to improve site-wide knowledge and awareness. For instance, one manager shared a time when he observed one worker repeatedly forgetting his safety vest. Rather than going to the individual worker, he discussed the importance of getting everyone together to reiterate the purposes of safety vests on site, focusing on instances when it might be raining or foggy, limiting visibility of truck drivers on site. In contrast, H&S observations that function to identify operational changes on site were discussed as more structured and planned within managers' everyday risk management strategies. For example, one participant discussed the value of working with the night shift for a while to know what hazards those employees faced that daylight shift did not. He said, “So from seeing that at night we put brand new lights... I had the plant turned down a little bit. Let's not get in our regular production mode because now all of a sudden it's dark—my reaction time's different, my sight time's different, all this stuff comes into play. But there was a lot of good that came out of it by recognizing that there was—there are risks involved and then going and addressing them.”

When describing the context for job observations as a regularly occurring activity, H&S leaders emphasized the more formal organizational activities, such as operations-level H&S quarterly assessments. In general, however, unplanned H&S focused job observations seemed to occur more throughout a typical workday. Regardless of whether observations were planned or unplanned, the primary purpose was not to monitor employee behavior but rather ensure that risks were consistently identified and mitigated on site.

The value of different “sets of eyes” in inspections and audits

H&S leaders provided several examples detailing how they use inspections and audits as a part of their operations and process management. H&S leaders often described interactions with people outside their site operation, such as vendors who assist with hazard inspections and audits. Participants discussed audits and inspections as a regularly occurring activity that serves as an opportunity for site-level H&S leaders to become more aware of their workplace risks and better ways to manage risks. They also noted the importance of documenting and communicating these hazards in some capacity. Finally, participants continued to emphasize the importance of collaboration on site to gain a holistic view of risk perceptions on site. For example, one participant said: “You have select people from different plants that all come together and come and look at our plant.... But out of that they’ve identified some risks, they’ve identified some hazards, they’ve identified little things, not major things where we said, Oh shoot let’s shut down, but little specific things like, You know what, you did a great job here on the lighting. Why didn’t you do this shop? ... just different perceptions of risk.”

Constant change in site-specific high-risk activities

Participants frequently discussed their efforts to capture and maintain a registry of site-specific activities. Their examples pointed to a keen awareness of the unique site-level needs and the specific intersecting issues among environmental, equipment, processes and personnel that need to be considered. The constant state of change inherent in these issues requires an up-to-date registry of high-risk activities for everyone to be aware of on the job. For instance, some participants reported the importance of registries for outside visitors while some focused more on their full-time employees who work in higher-risk areas on site. Examples: “I’m more worried about customers. As we import material and we have [to] export material the customers are a greater risk to the loaders. We have backup cameras truck drivers, traffic patterns, language issues. We’ve got more signs out here. It looks like you’re at a New York airport out here.”

Participants noted discussing the importance of alerting employees about new hazards or risks identified on the site. However, because each site has its own specific risks to watch for and document, and these hazards constantly change, managers noted it can be difficult to keep everything documented and up to date to the degree they would prefer.

Conclusion

The goal of this paper was to make more visible the day-to-day practices associated with operations-level risk management using the risk management practices described in CORESafety’s HSMS framework. Therefore, the analysis focused on themes and patterns related to how the risk management practices are executed by mine site-level leaders. As an exploratory study, these results are not generalizable to other mine-site leaders and their risk management practices. As such, limitations to this analysis include assessment of day-to-day practices against a formalized risk assessment or management framework. We also did not ask the mine site-level leaders their level of knowledge, skills or experience with formal risk assessment or management frameworks. Those would be topics for another study.

While aligned with CORESafety risk management practices, we identified several gaps both during our discussions with managers and throughout our analysis of the risk management practices that can help inform future risk management strategies. More specifically, research about the optimal ways to formally act upon risks identified on site and later check controls that were put in place to mitigate risks, are needed. This is important for greater linkage to more formal assessment and alignment of risk mitigation to leading or lagging indicators of system effectiveness.

First, a majority of the risk management examples provided by participants throughout the interviews were discussed as being “unplanned,” or “on the spot.” It is encouraging that these H&S managers possessed the common sense, yet quick, analytical thinking needed to proactively identify or mitigate a potential incident on site. However, many examples found in this analysis consisted of participants’ reactive responses to worksite risks rather than proactive efforts. The emphasis on reactive responses could be due to the high number of unplanned risk management practices that managers engage in while they are traversing their site facilities, such as showing a safer way to complete a task, reminding workers to wear the required personal protective equipment, or completing a pre-task risk assessment. While these unplanned discussions are critical to prevent an incident from happening in the moment, they may not be as effective for preventing future incidents, given the quick nature of the interactions. Therefore, it may be useful to try to formalize risk management practices after they informally occur, as a way to help disseminate risk management practices to the rest of the site. Additionally, formally disseminating these practices to the rest of the workforce could provide opportunities for more structured trainings, enhance situational awareness on site and improve communications for guiding and directing other employees’ health and safety behaviors. A more in-depth study of formal risk management practices is needed to guide this line of inquiry.

Second, nearly all H&S leaders interviewed spoke about the need for more “checking” in their risk management practices. Particularly, participants often reflected on the challenges associated with following up on the effectiveness of previously implemented risk and hazard controls. For example, one manager said, “I’m not so sure that we’re following up on particular instances that are happening that—where maybe when you do have that it’s a rule of thumb that within a month or two you talk about it again, within two months you do—I mean I don’t know but maybe there’s a pattern there that would help but I don’t believe we’re there yet, at least in my area of doing that.”

When discussing how managers verify if controls are effective, participants provided few concrete examples. This lack of tangible practices indicates that more research is needed to identify and determine the most effective ways to check risk management controls that are put in place on site. This may include research that focuses on operationalizing the “check” aspect of the PDCA cycle to make it visible and ultimately measurable.

This exploratory study sought to identify examples of the day-to-day risk management practices of H&S leaders in the mining industry. Knowledge gained through this analysis may help improve site-level leadership development efforts, including more formal risk assessment and risk management training, formal documentation of communication around

potential hazards and incidents, and determining ways to more formally document these activities. Future research studying the intersection of the human behavioral aspects, through visible worker and H&S leader practices, with organizational and technical aspects, through operationalized risk management systems, may be able to better capture proactive examples of the “how, why, and/or what” of HSMS implementation and in turn identify examples of leading and lagging indicators necessary for operational effectiveness.

Acknowledgments

The authors wish to thank Bob Peters and Joel Haight for their support in completing this study and Danny Gao and Nicole Ortiz for their assistance in data management and analysis. The authors also wish to thank the cooperating mine operators and leadership for openly sharing their experiences.

References

- Armstrong D, Gosling A, Weinman J, Marteau T. The place of inter-rater reliability in qualitative research: An empirical study. *Sociology*. 1997; 31(4):597–606. <https://doi.org/10.1177/0038038597031003015>.
- Babbie, E. *The Practice of Social Research*. 8. Wadsworth Publishing; Belmont, CA: 1998.
- Bennet J, Foster P. Predicting progress: The use of leading indicators in occupational safety and health. *Policy and Practice in Health and Safety*. 2005; 3(2):77–90. <https://doi.org/10.1080/14774003.2005.11667663>.
- Boyatzis, RE. *Transforming Qualitative Information: Thematic Analysis and Code Development*. Thousand Oaks, London, and Sage Publications; New Delhi: 1998.
- Corbin, J., Strauss, A. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. 4. Thousand Oaks, CA: Sage; 2015.
- Denzin, NK., Lincoln, YS. *The Sage Handbook of Qualitative Research*. 4. Thousand Oaks, CA: Sage Publications; 2011.
- Haight JM, Yorio PL, Rost KA, Willmer DR. Safety management systems comparing content and impact. *Professional Safety*. 2014; 59(2):44–51.
- Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977; 33:159–174. <https://doi.org/10.2307/2529310>. [PubMed: 843571]
- National Mining Association. *Handbook: About CORESafety and Health Management System*. 2012.
- National Mining Association. *Rules governing the Sentinels of Safety Program*. 2014. http://www.nma.org/pdf/sentinels_rules.pdf
- Rost KA, Willmer DR, Haas EJ. An operant analysis of leadership practices in mining. *Journal of Safety, Health and Environmental Research*. 2015; 11(2):234–241.
- Yorio, PL., Willmer, DR. Explorations in pursuit of a risk-based health and safety management systems. *SME Annual Conference & Expo*; Feb. 15–18, 2015; Denver, CO. Englewood, CO: Society for Mining, Metallurgy & Exploration; 2015.
- Yorio PL, Willmer DR, Moore SM. Health and safety management systems through a multilevel and strategic management perspective: theoretical and empirical considerations. *Safety Science*. 2015; 72:221–228. <https://doi.org/10.1016/j.ssci.2014.09.011>.
- Watzman B. Driving continuous improvement in US mine safety performance—a new approach. *Mining Engineering*. 2014 Jan.:29–31.

Table 1

Interview structure with HSMS indicators and example questions.

HSMS indicator	Example question
Occupational health management.	“What happens if someone gets hurt during the shift?”
Senior management commitment.	“What are some of the short-term and medium-term measures and targets used to check whether the company is meeting its safety goal?”
Continuous improvement.	“Describe a health and safety problem that was identified and dealt with in a way that people think is successful.”
Risk management.	“How is an incident evaluated by the organization? Can you give me an example to describe the evaluation?”
Communication.	“What activities or practices does the company use to communicate health and safety messages?”
Competence.	“How does the company make sure that the employees know how to handle emergencies?”
Employee involvement.	What are other ways you think employees could get involved in improving company health and safety?”

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 2

Health and safety leaders' daily risk management practices coded results. (RM = risk management)

NMA CORESafety RM practice	Coded RM examples in interviews (<i>n</i> = 334)	Overall percentage of coded RM examples
Allow employees to formally contribute to hazard identification process.	71	21.3%
Conduct H&S focused job observations at regular intervals.	52	15.5%
Conduct hazard inspections and audits at regular intervals.	35	10.4%
Require employees to perform pre-task risk assessments.	27	8.0%
Perform risk assessments for high-risk jobs.	9	2.7%
Perform risk assessment on mining processes and equipment.	18	5.4%
Perform risk assessments for routine and repeatable jobs.	22	6.6%
Maintain an up-to-date registry of site-specific high-risk activities.	49	14.7%
Verify, at regular intervals, that risk and hazard controls are effective.	51	15.3%

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript