



U.S. Department
Of Transportation

**Federal Railroad
Administration**

Research Results

RR06-18
August 2006

A Pilot Examination of a Joint Railroad Management-Labor Approach to Root Cause Analysis of Accidents, Incidents, and Close Calls in a Diesel and Car Repair Shop Environment

SUMMARY

A 1-year (yr) pilot study investigated the feasibility and practicality of a joint railroad management-labor approach to root cause analysis (RCA) of accidents, incidents, and close calls in a diesel and car repair shop environment. The primary objective of the study was to evaluate the adequacy and utility of a joint railroad management-labor RCA process. Participating labor and management identified seven RCA opportunities during the study period; however, only one led to investigation. Participants identified a number of barriers that made it difficult for the project to succeed in its current form. Key barriers included a lack of study leadership; poor interaction and communication between labor and management participants and between participants and the employees involved in the accidents, incidents, and close calls; challenges with employee participation; perceived minimal opportunity to conduct RCAs; and complexity of the RCA tools and process. Participants also identified a number of suggestions to address these barriers. Finally, this study identifies additional lessons learned and offers recommendations for future implementation of a joint labor-management RCA process.



Figure 1. Diesel and Car Repair Shop Environment.



BACKGROUND

Safety in the railroad industry improved markedly over the last decade, with the total accident/incident rate in the railroad industry falling from 26.37 per million train miles (mtm) in 1996 to 17.39 per mtm in 2005. In addition, there has been a decline in employee injuries and fatalities. In 1996, there were 9,199 on-duty railroad employee injuries and 33 fatalities. In 2005, there were 5,557 on-duty railroad employee injuries and 25 fatalities. While the total accident/incident rate and number of employee injuries decreased over this time period, the number and rate of train accidents increased, from 3.64 train accidents per mtm in 1996 to 3.99 train accidents per mtm in 2005. Understanding the diverse set of contributing factors that allow an accident/incident to occur is an effective way to reduce these occurrences and increase safety. The goal of this research was to investigate the value and utility of a joint railroad management-labor approach to human factors-based RCA investigations of accidents, incidents, and close calls in a diesel and car repair shop, as well as to uncover contributing factors at various levels of a railroad system.

RCA is a systematic approach to accident, incident, and close call investigation that enables one or more individuals to identify individual, organizational, technological, and situational factors that contributed to each accident, incident, or close call. A guiding principle behind RCA is: a single event is not responsible for an accident, incident, or close call. Rather, multiple factors play a role in every accident, incident, and close call, and it is important to identify and understand each factor to successfully mitigate future occurrences.

The research team chose the Human Factors Analysis and Classification System (HFACS; Wiegmann & Shappell, 2003) to provide the theoretical backbone to the RCA. HFACS has its basis in James Reason's (1) generic error modeling system and (2) Swiss cheese model of accident causation (Reason, 1990). The Swiss cheese model describes accidents as arising from holes in an organization's defenses at various levels of the organization, beginning with the operator and working up to organizational decisions and conditions. Active failures by the operator combine with latent conditions or factors upstream in the organization to lead to an accident (or incident or close call). According to Reason's model, accidents (and incidents and close calls) occur when all active and latent factors (i.e., holes)

line up to allow accident energy to penetrate these various organizational levels. Accidents (and incidents and close calls) are prevented when an organization's defenses and barriers prohibit the alignment of active and latent factors and conditions.

HFACS has a logical structure and is a scientifically valid approach to human error. Furthermore, according to its authors, HFACS is diagnostic, reliable, and comprehensive as a classification system. This is critical because the taxonomy must accommodate a wide range of railroad operational situations that can lead to accidents, incidents, and close calls. HFACS was developed initially for the aviation domain. As a result, the research team made some minor changes to HFACS to optimize its relevancy to the railroad industry. Researchers renamed the modified HFACS taxonomy HFACS-Railroad (HFACS-RR).

OBJECTIVES

The primary objective of this research was to gain an understanding of the potential for railroads and labor to jointly conduct human factors-based RCA investigations of accidents, incidents, and close calls to uncover contributing factors at various levels of the railroad system. The focus of the project was participant feedback on implementation of the RCA method and tools, as well as the utility of the approach for the railroad industry in general.

METHODS

Researchers selected the diesel and car repair shop setting as the study environment because the RCA process required a location where labor and management were co-located, and this environment hosts a variety of skilled craft workers, providing access to a variety of job types and numerous and varied work experiences throughout each day.

Researchers invited representatives from several railroads and labor unions, as well as the Federal Railroad Administration (FRA), to participate in a stakeholder meeting in April 2004. One railroad and four labor unions subsequently agreed to participate in the pilot study.

Researchers developed a set of paper-based tools based on HFACS-RR to guide investigators



through the data collection and analysis process. Researchers conducted a 2-day training session at the host railroad with management and labor representatives in November 2004. The training served to educate and familiarize participants on

the principles of RCA, the HFACS-RR taxonomy of human error, and the specific RCA tools and methodology for data collection and analysis.

Candidate occurrences for RCA included all accidents, incidents, and close calls that took place in the diesel and car repair shop environment, regardless of whether the event met FRA reporting criteria. The accident, incident, or close call had to involve a member of a participating union. Researchers excluded events where the Federal Employer's Liability Act (FELA) might be involved.

Labor and management agreed to allow labor representatives to conduct each RCA on their own, while management representatives would be available to assist as needed.

RESULTS

The initial data collection period lasted 6 months (mo), from November 10, 2004, to May 10, 2005. Because participants conducted only one RCA in this time period, the researchers extended the data collection period an additional 6 mo to the end of November 2005. In the end, participants identified a total of 7 RCA opportunities during the 1-yr study period but investigated only 1 incident using the RCA tools and method. One labor and one management representative jointly performed the single RCA. They identified five contributing factors associated with three of the five HFACS-RR levels.

A number of barriers prevented more successful implementation of the RCA process and tools. Researchers conducted telephone interviews with participating management and labor representatives to obtain feedback on these barriers and to solicit suggestions for future implementation.

Key themes among barriers identified include the following:

Lack of leadership. Participants felt that labor and management lacked strong leadership to ensure the study's success.

Poor interaction and communication. Participants noted that it was awkward to interview a co-worker as part of the RCA process. Participants also

noted inadequate communication from some study participants to other diesel and car repair shop employees about the study, as well as from management to labor participants about the existence of accidents, incidents, or close calls.

Challenges associated with participation. Participants identified a lack of participant availability for one RCA and difficulty coordinating multiple participant and employee schedules to jointly conduct RCAs. In addition, concern over management retribution was a factor for one labor participant who chose not to support the study after the training. The same concern was noted as a possible factor for why those employees involved in an accident, incident, or close call chose not to cooperate. Some felt that FELA may have contributed to limited cooperation by employees involved in accidents, incidents, or close calls.

Perceived minimal opportunity to conduct RCA. Some perceived few opportunities to investigate accidents, incidents, or close calls due to the relatively safe diesel and car repair shop work environment.

Complex RCA tools and process. At least one participant felt that participation may have been hindered because the RCA tools and method may be too complicated and the training may have been insufficient.

Based on study participant feedback and pilot study experience, the research team made the following recommendations to increase the likelihood of success of any future attempt at implementing a joint management-labor RCA process:

Expand study to all yard crafts. Any future study should include the entire yard environment, including train and engine employees. This strategy will increase the number and types of opportunities to conduct RCA.

Draw on the railroad's safety committee(s) to provide study participants, and use the safety committee venue to discuss, raise awareness of, and select events to analyze. Safety committee members could serve as representative labor and management participants; in addition, accidents, incidents, and close calls brought to the attention of the safety committee could serve as possible candidates for RCA.

Communicate information about the study to, and solicit cooperation from, all railroad employees. The railroad might consider posting a general



notice to all employees to accomplish the following: inform them about the project; ask employees to notify participating labor or management representatives about any accident, incident, or close call in which they were involved; ask employees to cooperate in any RCA process; and encourage employees to cooperate, making it clear that both labor and management sanction their participation. Participating labor unions may also consider posting a similar notice to their members. Enhancing the process of communicating the existence of accidents, incidents, and close calls to study participants will help ensure few missed opportunities resulting from omissions or delays.

Train participating labor and management representatives to better recognize RCA opportunities. Participants' increased ability to recognize RCA opportunities will improve the overall likelihood of successfully completing a number of RCAs.

Identify one labor and one management representative to be study champions. Select one labor and one management representative as overall study co-chairs, whose jobs are to act as a conduit of information and serve as study administrators. These two chairs could have specific roles, such as identifying RCA opportunities, assigning participants to conduct the RCA, communicating information to their relative constituents (labor and management), and performing general problem solving. These chairs could also act as liaisons among the participating railroad, labor organizations, and researchers, to provide assistance and answer questions that arise.

Indemnify participating labor and management involved in RCA (both participants and involved employees) so that neither labor nor management can use information collected in the RCA against

the other party. Indemnification should reduce concerns over retribution and FELA. This, in turn, should increase the number of those who participate as labor and management participants and employees who have been involved in an accident, incident, or close call. Indemnification may require some type of written agreement.

CONCLUSIONS

In conclusion, researchers and research participants encountered a number of barriers in this pilot study. These barriers impeded successful use of a joint labor-management approach to RCA of accidents, incidents, and close calls in a railroad work environment. These barriers, however, do not necessarily indicate a failure of the RCA process or tools. Instead, these barriers highlight challenges that must be addressed before trying to implement this type of approach in the future.

ACKNOWLEDGMENTS

Foster-Miller, Inc. performed this study under the direction of Dr. Thomas Raslear, FRA Office of Research and Development. The study would not have been possible without generous assistance from participating railroad and labor union representatives.

CONTACT

Dr. Thomas Raslear
Federal Railroad Administration
Office of Research and Development
1120 Vermont Avenue NW
Washington, DC 20590
Tel: (202) 493-6356
Fax: (202) 493-6333
Email: Thomas.Raslear@dot.gov

KEYWORDS: Root cause analysis, accident/incident investigation, human error, diesel shop, car repair shop, railroad safety

Notice and Disclaimer: This document is disseminated under the sponsorship of the United States Department of Transportation in the interest of information exchange. Any opinions, findings and conclusions, or recommendations expressed in this material do not necessarily reflect the views or policies of the United States Government, nor does mention of trade names, commercial products, or organizations imply endorsement by the United States Government. The United States Government assumes no liability for the content or use of the material contained in this document.
