

# Accident Investigations

*One element of an effective safety culture*

**By Carol Boraiko, Tom Beardsley and Eva Wright**

**T**O EVEN THE MOST CASUAL OBSERVER, organizational culture is seen as a critical factor in achieving corporate performance and safety goals, such as the reduction of recordable and lost-workday injury rates. Manuele and Christensen (1999) state that culture is a set of shared perceptions, values, beliefs and assumptions that determine how individuals see reality and how it affects their behavior (1999). At General Motors (GM), the safety culture is built and shaped by leadership initiatives in what are termed the five core elements of a safety-oriented culture. These elements are safety observation tours, employee safety concern process, plant safety review boards, safe operating practices and accident investigations (see sidebar on p. 27). All five elements contain a unique method, termed I Care, that allows management to become more involved in molding the safety culture.

The scope of this article is limited to the accident investigation element. It highlights the key components of a properly conducted accident investigation and how this process can be used to influence the culture and employees' perception of workplace safety. It also highlights the use of the I Care message while conducting the investigations.

## **Preventing Accidents**

GM's (2007) safety policy states that all accidents can be prevented. The primary reason to perform an

accident investigation is to determine causal factors in order to prevent the recurrence of a similar incident. To ensure this, information obtained during the investigation about the conditions and actions that caused the event must be accurate. Otherwise, the subsequent intervention may not address the real cause(s).

Since incident investigation is a reactive approach, GM combines it with job hazard analysis (JHA)—a proactive strategy. JHAs involve observation of and interviews with workers to establish a baseline of all steps required to successfully complete a task and to analyze its unique hazards. This management/employee interaction reinforces the I Care message.

Information required for an accurate and useful incident investigation includes a description of the worker's assigned tasks as described in the JHAs and a description of the event. The JHA information is used to critique the hazards associated with the task and how the worker interacts with the task. The incident description explains the conditions and actions that could have contributed to incident causation.

Information captured in the description includes:

- details of the injured person (e.g., name, job title, age, length of employment);
- nature of injury;
- affected body part;
- severity of injury;
- location of event;
- body orientation to the job;
- environmental conditions when the incident occurred;
- occurrence of manual materials handling and, where applicable, the size and weight of the material and the frequency of handling (UAW-GM, 1998; National Safety Council, 1997).

These details should answer several questions:

- What happened?
- When did it happen?
- Where did it happen?
- How did it happen?

The investigation is not complete until these basic questions are answered satisfactorily.

Once task information and a complete incident

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description are obtained, the next step is to determine incident cause(s). The result of this analysis is what drives corrective actions. Several accident analysis tools can be used to identify contributing factors and distinguish an incident's root cause(s). These include failure modes and effects analysis (FMEA), cause-and-effect diagram and current reality tree (Dettmer, 1997; Doggett, 2004; Manuele, 2003; Stamatis, 2003). The sidebar on pp. 28-29 provides additional information on these strategies.

Whichever analytical method is selected, it must provide sufficient information to determine the probable contributing factors, the conditions leading to those factors and the possible reasons leading to those conditions.

GM also uses the 5-why process to identify root causes. This tool was developed using six sigma techniques. It was selected partially because it is easy to use—it does not require advanced statistical analysis or data collection—and it allows the personal contact needed to foster the I Care message. By asking enough times why something happened or why a condition or

circumstance exists, the process, by design, will “peel away the layers of symptoms” associated with a problem and reveal its root cause (UAW-GM, 1998). Of course, care must be taken when using anecdotal evidence since it has to be verifiable.

The 5-why analysis follows a structured question-and-answer sequence that contains a feedback loop to the previous question. This process continues until an answer provided is unacceptable and cannot be justified. Once this occurs, the root cause should have been identified as one of the last question/answer sets (UAW-GM, 1998). Using this method, the investigator can determine the why(s) leading to the most probable causes of the incident. This method also allows the implementation of effective corrective actions that will eliminate the unsafe conditions or work practices.

### **Demonstrating a Caring Attitude Cultivates an Ideal Safety Culture**

Embedded in the 5-why analysis is GM's use of the I Care program to improve safety culture through the

**Abstract:** *General Motors has identified several elements needed to build an effective safety culture. One of these elements is accident investigations. Commonly conducted to identify the factors and causes that either contributed, a company must ensure that these investigations are not perceived as a way to place blame on the worker. This article examines how leaders and management can use them to personally demonstrate their expected level of commitment to safety.*

## **Five Core Elements of a Safety-Oriented Culture**

All five of GM's core elements contain the requirement for fostering the I Care message.

### **Element 1: Safety Observation Tours**

A safety observation tour is a walk-through of an area of the plant to observe employees in action and to speak with them about safe work practices. Done appropriately, these tours help to:

- identify safety and health risks;
- gather safety and health performance data;
- check employees' understanding of safety and health requirements;
- respond to unsafe acts/conditions;
- recognize and reinforce strong safety and health performance;
- gather employee input and feedback about safety and health issues;
- educate employees about safety and health;
- demonstrate the I Care message through frequent, visible, personal contact with employees.

### **Element 2: Employee Safety Concern Process**

This process is a companywide method for identifying, investigating and resolving safety concerns that employees bring to their leaders. Its purpose is to:

- collect, catalog, track and respond to employee concerns;
- expand employee participation in the safety process;
- assign accountability for following up on concerns;
- demonstrate the I Care message.

### **Element 3: Plant Safety Review Boards**

A plant safety review board is a steering committee that can include the following people: plant manager, plant manager's direct reports, UAW chairperson, SH&E personnel, UAW committee members, medical personnel and the plant personnel director. This board requires the plant leadership to address safety and health issues brought forward by its members and any subcommittees. One of its purposes is to send the message that management cares to employees. It is also another way to emphasize that everyone's safety is important.

### **Element 4: Safe Operating Practices**

A safe operating practice (SOP) is a management tool that describes the required steps for completing a work operation in the safest possible manner. SOPs are designed, tested and confirmed by a team of subject-matter

experts—employees who have experience in and detailed knowledge of the work operation they are documenting. SOPs can reduce risk to employees while they are performing work tasks. They also contribute to high process and product quality. Creation and maintenance of SOPs in all required areas further demonstrates that management cares about employees.

### **Element 5: Accident Investigations**

An accident investigation is a procedure for documenting, analyzing and addressing an incident that results in a near-hit or a recordable injury or illness. These investigations are used to:

- neutralize immediate/persistent threats to safety and health;
- inform key leaders as necessary;
- determine the depth of investigation required;
- catalog the facts of the incident;
- identify root causes;
- identify the appropriate responses to prevent recurrence;
- demonstrate the I Care message through prompt, personal attention to incidents.

*Note.* From “Leading UAW-GM Health and Safety Culture, by UAW-GM Center for Human Resources., 2003, Detroit, MI: UAW-GM Center for Human Resources.”

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use of incident investigation techniques. By demonstrating personal commitment to employee safety, managers show those involved in an incident that management cares. This indicates that leaders are committed to ensuring that investigations are conducted properly and that the information gained through them is used to prevent a recurrence.

Management leadership is the key to creating a safety culture that demands a hazard-free environment. According to Manuele (2003), management must be part of the accountability system for accident investigation. At the GM Spring Hill Body Systems Business Unit, which produces steel stampings, plastic injection

moldings, metal body welding, and in-the-site painting operations, management implemented two additional facets within the incident investigation process in order to integrate that process further into the organizational culture: 24-hour accident reviews, which are followed by weekly follow-up reviews. The primary purpose of these reviews is to show employees that management cares and to improve the quality of investigations and resulting corrective actions.

The 24-hour accident review is conducted by the plant manager's staff with the injured employee and his/her supervisor. Within 24 hours of an incident, the review team discusses (and documents) the events leading up to the event with the injured employee—thus involving the employee from the beginning.

During the review, the plant manager further demonstrates a caring attitude by discussing the job assignment with the employee—this is a positive interaction designed to help determine how the accident occurred. Any behavioral issues (e.g., operator error, taking shortcuts, working out of station) revealed during this process are discussed openly and constructively.

The plant manager also

encourages the employee involved to serve as a teacher to share his/her experiences with other team members so they can avoid a similar incident. Having the employee act as a teacher demonstrates that management and staff working together can foster an ideal safety culture. If the employee is uncomfortable in this role, the team leader can review the incident details with the team.

The weekly follow-up review focuses on the incident's root cause(s); its purpose is primarily problem solving. This review also confirms the adequacy and acceptability of the corrective measures, as determined through the 5-why analysis by the plant manager, plant staff and the injured employee. Discussion of discipline during this meeting is expressly prohibited. The completed investigation report is presented to the plant manager and plant staff by the supervisor of the injured employee's team. Corrective actions and time lines are reviewed by management staff and the employee team with a focus on hazard elimination. This involves employees on an individual level in a safety process that is designed to keep them from being injured. In the end, these two processes create ambassadors for safety throughout the workforce.

### **Conclusion**

Since the integration of the I Care component into the incident investigation procedure in early 2004,

## **Accident Analysis Tools**

Several accident analysis tools can be used to identify the contributing factors and distinguish an incident's "root" cause(s). A few common examples are described here.

### **Failure Modes & Effects Analysis**

Failure modes and effects analysis (FMEA) is a formal method for conducting a hazard analysis. It is the consideration of the failure for each component within a specific system. This technique can be accomplished with diverse methods, the use of historical data or the use of modeling or simulations.

A complete FMEA will include:

- a description of the system to be analyzed;
- failure mode (known or potential);
- effects on other areas of the system or a separate system;
- severity and frequency information (criticality);
- methods to assess hazard;
- corrections to be used with follow-up information.

### **Cause-and-Effect Diagram**

A cause-and-effect diagram (CED) is a tool to separate, sort and assess possible causes of a hazard. It allows the user to develop a graphic illustration showing the relationship between causes and factors that can influence the outcome. It is also called an Ishikawa diagram (named for Kaoru Ishikawa) or a fishbone diagram because of its shape.

Benefits of using a CED include:

- root causes are determined using a structured approach;
- use of a methodical format to diagram cause-effect associations;

injury rates and lost-workday rates have declined within the Body Systems Business Unit at GM's Spring Hill, TN, facility (Table 1). (It should be noted that until approximately 2004, the Spring Hill facility operated under slightly different safety matrixes as a Saturn manufacturing facility.)

These results indicate that the caring message component of the incident investigation process reinforced the safety culture at this facility. While this component cannot replace incident investigations, it supplements the facility's ever-evolving safety culture.

During any investigation, it must be made clear that the employer cares about the safety and welfare of all employees. Theoretically, when workers realize that their employer cares about their safety and health, they develop a trust with supervisors and are actively conscious of how their actions affect their safety.

The use of incident investigation techniques to change the safety culture is not a concept unique to GM. Ferry (1988) notes that mishaps (including accidents) are a sign of inefficient operations and poor operating practices. In addition, he states that correcting them will not only reduce the opportunity for more mishaps, it will also result in more efficient operations.

- increased knowledge of the process among affected personnel who assess the factors at work;
- areas where data should be collected for further study are identified.

### Current Reality Tree

A current reality tree (CRT) is used to identify the relationships between undesirable effects (UDE) that lead to the hazard or root cause. Its purpose is to understand how aspects of problems are related—to each other and to the root causes identified. A CRT is constructed using a series of statements associated with the hazard or situation using the “if/then” or “if/and if/and if/then” cause-and-effect relationships. The undesirable effects do not identify the true problem—they are the effects that are visible, resulting from the root problem or cause.

CRTs are used to accomplish several objectives:

- provide the foundation for working with an intricate system;
- recognize UDEs within the system;
- relate UDEs to one another using cause-and-effect questions to lead to the root cause;
- identify core UDEs and classify those that are outside the span of control of influence;
- identify changes to UDEs that offer the best return on investment.

**Table 1**

## Safety Indicators for Body Systems

	2004 <sup>a</sup>	2005 <sup>a</sup>	2006 <sup>a</sup>	2007 <sup>b</sup>
Injury rate	4.91	6.25	4.03	3.97
Lost-workday rate	0.87	0.98	0.67	0.61

*Note.* Business unit at the Spring Hill, TN, facility.  
<sup>a</sup>Year end. <sup>b</sup>End of production 3/31/07.

GM also collects and tracks the data on several leading indicators: attendance and knowledge gained in primary safety training, lockout of power sources, materials handling, confined spaces, mobile equipment use, fork trucks, exposure assessments to chemicals and the number of near-hits. However, the company believes that the reduction in the number and severity of actual injuries is the true indicator of the progress within its safety culture. In addition, improvements in these injury metrics are realized in many other areas of the business, including cost, schedule and quality. All of these improvements reinforce the importance of the safety and health program and highlight the need for a strong, enduring relationship between workers and management. ■

*It must be made clear that the employer cares about the safety and welfare of all employees. When workers realize that their employer cares about their safety and health, they develop a trust with supervisors and are actively conscious of how their actions affect their safety.*

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