Fleet Safety

for Safety Professionals and Fleet Managers

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Chapter 7

Sustainability and the Safety, Health, and Environmental Professional

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LEARNING OBJECTIVES

- Understand what sustainability is and what is driving this business strategy.
- Learn about the Global Reporting Initiative (GRI).
- Be able to clarify the relationship between sustainability and social responsibility.
- Recognize the value of the integration model: safety and continuous improvement within sustainability.
- Discuss legislation, standards, and market influences on sustainability.
- Learn about ISO 26000, Guidance on *Social Responsibility*, and its relationship to occupational safety and health.
- Discover from case studies how companies are integrating safety into their sustainability strategies and reporting.

In today's workplace, an OS&H professional can expect to hear or read about sustainability; Global Reporting Initiative (GRI); corporate social responsibility; lean, continuous improvement; and "green." These terms and conditions, while related to each other, can often cause confusion. This chapter puts various strategic issues into context to help readers better understand the big picture of sustainability. Employee safety is currently viewed as one small part of the overall equation, but it should be viewed as a more important ingredient for long-term success in any organization.

The first part of this chapter provides an historical overview of topics related to sustainability. Later sections will describe these topics and present case studies to demonstrate the link between safety and sustainability.

SUSTAINABILITY

Sustainability embodies *stewardship* and *design with nature*—well-established goals of design professionals—and *carrying capacity*, a highly developed modeling technique used by scientists and planners.

The most popular definition of sustainability can be traced to a 1987 UN conference. It defined sustainable developments as those that "meet present needs without compromising the ability of future generations to meet their needs" (WECD 1987). Gilman extends this goal-oriented definition by stating that "sustainability refers to a very old concept (the Golden Rule) . . . do [unto] future generations as you would have them do [unto] you" (Gilman 1990, 1996).

These well-established definitions set an ideal premise but do not clarify specific human and environmental parameters in modeling and measuring sustainable developments. The following definitions are more specific:

- Sustainable means using methods, systems, and materials that will not deplete resources or harm natural cycles (Rosenbaum 1993).

- Sustainability "identifies a concept and attitude in development that looks at a site's natural land, water, and energy resources as integral aspects of the development" (Viera 1993).
- Sustainability integrates natural systems with human patterns and celebrates continuity, uniqueness, and placemaking (Early 1993).

The 1970 National Environmental Policy Act (NEPA) formally established as a national goal the creation and maintenance of conditions under which humans and nature "can exist in productive harmony, and fulfill the social, economic and other requirements of *present and future generations of Americans"* [emphasis added] (EPA1970).

The concept of sustainable development was described in a 1981 White House Council on Environmental Quality (CEQ) report: "The key concept here is sustainable development. If economic development is to be successful over the long term, it must proceed in a way that protects the natural resource base of developing countries" (White House 1981).

A later concept of sustainability that took root in the global arena was an outgrowth of the 1987 Brundt- land Commission (named for the chair) for the United Nations (UN WCED 1987). This concept of sustainability was based upon the concept of the *triple bottom line*—balancing environmental concerns and social needs with economic issues. Sustainability may be envisioned, as depicted in Figure 1, as the confluence of the three pillars (3 Ps): social (people), economic (profit), and environmental (planet). Sustainability is a very complex subject that includes biodiversity, climate change, carbon footprint, and so on. For purposes of discussion in the safety, health, and environmental (SHE) community, it seems best to deal with the practical aspects of the 3 Ps that safety, health, and environmental professionals may impact or influence.

Sustainable growth is not possible without a culture of continuous improvement. This chapter will demonstrate how continuous improvement provides the foundation for an organizational culture capable of attaining the triple bottom line. First of all, there must be an introduction to the current guidelines for organizations that choose to report their progress on sustainable growth. These guidelines are contained in the Global Reporting Initiative (GRI).

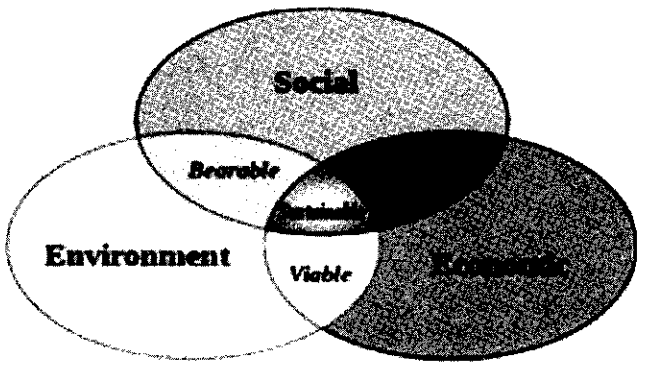

FIGURE 1. Confluence of sustainability
(*Source:* Dréo 2006/2007; adapted by Mike Taubitz)

Global Reporting Initiative (GRI)

The GRI provides the framework for voluntary reporting of initiatives related to sustainable growth. Table 1 presents definitions that pertain to sustainability, including their sources, Web sites, and a discussion of each. It generally addresses the elements of waste from the business process, including time and effort.

GRI Vision

The vision of the GRI is that disclosure on economic, environmental, and social performance becomes as commonplace and comparable as financial reporting, and as important to organizational success.

GRI Mission

GRI's mission is to create conditions for the transparent and reliable exchange of sustainability information through the development and continuous improvement of the GRI sustainability reporting framework.

The GRI is a network-based organization that has pioneered the development of the world's most widely used sustainability reporting framework and is committed to its continuous improvement and application worldwide (GRI 2007).

In an effort to ensure technical quality, credibility, and relevance, the reporting framework was developed through a consensus-seeking process with global participants drawn from business, society, labor, and professional institutions. The cornerstone of the framework is the sustainability reporting guidelines. The third version of the guidelines, known as the *G3 Guidelines,* was published in 2006 and is available free to the public (GRI 2007).

Health and safety is but one small aspect of GRI under the heading of the International Labour Organization's (ILO) decent work agenda for labor practices (GRI 2007). Reporting guidelines from the ILO include the following:

- percentage of total workforce represented in formal joint management: worker health and safety committees that help monitor and advise on occupational health and safety programs
- rates of injury, occupational diseases, lost days and absenteeism, and total number of work-related fatalities by region

TABLE 1

Definitions and Discussion

Term	Definition/Source	Discussion
Carbon market	The carbon market grew out of carbon reduction and trading schemes as a result of the Kyoto Protocol and other carbon reduction commitments and regulations. The market tracks and trades carbon (in units of 1 ton CO_2 emissions) like other commodities (UNFCC 2010).	One of the ways organizations are meeting their commitments to their overall carbon emissions targets (locally, nationally and internationally).
Continuous improvement (CI)	Continuous improvement (CI) or continuous improve-ment processes (CIP) ccs.mit.edu/21c/iokey.html	Ongoing efforts to improve products, processes, and services.
Corporate social responsibility	A firm's sense of responsibility toward the community and environment (both ecological and social) in which it operates and draws resources and sustenance from. www.businessdictionary.com/definition/corporate-citizenship.html	Firms express this citizenship (1) through their waste and pollution reduction processes, (2) by contributing educational and social programs, and (3) by earning adequate returns on the employed resources.
Global reporting initiative (GRI)	A network-based organization that has developed the world's most widely used sustainability reporting frame-work and is committed to its continuous improvement and application worldwide. www.globalreporting.org/Home	The global reporting initiative (GRI) is a network-based organization that has pioneered the development of the world's most widely used sustainability reporting framework.
Green/Environment	Green is typically associated with any form of environ-mental initiative that reduces adverse impacts to the planet. www.epa.gov/greenpower	It is sometimes used interchangeably with sustainability. However, green is but one of three legs of sustainable growth.
Greenhouse gases	Gases that trap heat in the atmosphere. www.epa.gov/climatechange/emissions/index.html	Common greenhouse gases derived from human activity are: • Carbon dioxide (CO_2) • Methane (CH_4) • Nitrous oxide (N_20) • Fluorinated gases
Lean	The suite of tools and thinking employed by companies following the teachings of W. Edwards Deming.	The term lean was first introduced in 1990 with the book, The Machine That Changed the World. It generally addresses the elements of waste from the business process, including time and effort.
LEED®	Leadership in Energy and Environmental Design. www.usgbc.org	An internationally recognized green building certification system that provides third-party verification that a building or community was designed and built using strategies intended to improve performance; it is headed by the U.S. Green Building Council.
Kaizen	Incremental efforts driving continuous improvement.	A Japanese term [the translation of kai ("change") and zen ("good") is "improvement"].
PDCA	Plan-Do-Check-Act en.wikipedia.org/wiki/PDCA	Often referred to as the Deming Cycle, PDCA is an iterative four-step problem-solving process typically used in management systems that drive continuous improvement.
Sustainability	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. www.sustainabilitydictionary.com	An outgrowth of the 1987 UN Commission; referenced as the Brundtland Report and named for the Commission's Chair.
Triple bottom line	Financial, social, and environmental effects of a firm's policies and actions that determine its viability as a sustainable organization. www.businessdictionary.com/definition/triple-bottom-line.html	Sometimes referred to as the "3 Ps" for people, planet, and profit; the triple bottom line strategically balances competing requirements for long-term sustainable growth.

(Adapted by Taubitz from various sources)

- education, training, counseling, prevention, and risk-control programs in place to assist workforce members, their families, or community members regarding serious diseases
- health and safety topics covered in formal agreements with trade unions

To put things into context, the GRI labor practices section is twenty pages and is only a small part of the overall GRI guidelines. The guidelines are comprised of the following major sections (GRI 2007):

- application levels
- G3 guidelines

- the environment
- economics
- human rights
- labor practices
- product responsibility
- society

Considering Dr. Peter Drucker's statement, "What gets measured, gets managed" (Aaron 2008), it would seem that employee safety would not garner much management attention if one relies only on the areas emphasized by the GRI. It is incumbent upon SHE to find ways to integrate with GRI, not the other way around.

Let us turn to how corporate social responsibility fits into the picture.

Social Responsibility (SR) and Corporate Social Responsibility (CSR)

Social responsibility (SR) and *corporate social responsibility* (CSR) are interrelated, and can best be defined through the ISO 2600 standard on social responsibility (ISO 2010). *Social responsibility* refers to any organization's need to preserve resources for future generations and complements the traditional view that only private corporations have a duty to make products and provide services responsibly.

Although these terms are different and are driven by different organizations, they all point in the same general direction. Throughout the industrialized world and in many developing countries, there has been a sharp escalation in the social roles corporations are expected to play. Companies are facing new demands to engage in public/private partnerships and are under growing pressure to be accountable not only to shareholders, but also to stakeholders, such as employees, consumers, suppliers, local communities, policymakers, and the society at large (Noer et al. 2008).

Also known as corporate responsibility, corporate citizenship, responsible business, sustainable responsible business, or corporate social performance, *corporate social responsibility* is a form of corporate selfregulation integrated into a business model. CSR policy is intended to function as a built-in, self-regulating mechanism where the inclusion of public interest into corporate decision making facilitates achievement of a triple bottom line that benefits people, planet, and profit (BNET n.d.). The term corporate social responsibility has been used interchangeably with corporate responsibility, corporate citizenship, social enterprise, sustainability, sustainable development, triple bottom line, corporate ethics, and, in some cases, corporate governance. Social responsibility is used to suggest that all organizations, including government, nongovernmental organizations (NGOs), and professional organizations, need to be socially responsible.

ISO 26000

The International Organization for Standardization (ISO) finds that sustainability and social responsibility are closely related but different (ISO 2010). Sustainable development from the ISO perspective is about meeting the needs of society while living within the planet's ecological limits, without jeopardizing the ability of future generations to meet their needs. Social responsibility, on the other hand, has the organization as its focus and concerns an organization's responsibilities to society and the environment. Social responsibility is closely linked to sustainable development. Essentially, the main objective of an organization's social responsibility should be to contribute to sustainable development (ISO 2010).

ISO 26000, *Guidance on Social Responsibility,* is an international standard that helps organizations achieve the benefits of implementing policies on social responsibility (SR). Ninety-nine countries and 42 public- and private-sector organizations with liaison status were involved in the ISO working group on social responsibility under the joint leadership of the ISO members for Brazil (ABNT) and Sweden (SIS). The group included a geographical and gender-based balance of participants. Main stakeholder groups represented include: industry; government; labor; consumers; nongovernmental organizations; service, support, and research; and others. The American Society for Quality (ASQ) is the administrator of the U.S. Technical Advisory Group for development of ISO 26000 (ASQ 2010). Published in November 2010, ISO 26000 contains voluntary guidance, not requirements, and therefore is not for use as a certification standard, such as ISO 9001:2008 and ISO 14001:2004. ISO 26000 seeks to help all types of organizations, regardless of their size, activity, or location, to operate in a socially responsible manner by providing guidance on:

- concepts, terms, and definitions relating to social responsibility
- the background, trends, and characteristics of social responsibility
- principles and practices relating to social responsibility
- core subjects and issues relating to social responsibility
- integrating, implementing, and promoting socially responsible behavior throughout the organization
- its sphere of influence on various stakeholders
- identifying and engaging with stakeholders
- communicating commitments and performance related to social responsibility

The OS&H professional can benefit from a general understanding of social responsibility by obtaining a copy of ISO 26000. A review of the new ISO 26000, *Guidance on Social Responsibility,* will help the OS&H professional demonstrate the value safety management contributes to achieving organizational sustainability and social responsibility goals (ASQ 2010).

Whereas sustainability evolved from the United Nations, it is the ISO that has been driving efforts on social responsibility. In October 2010, ISO 26000:2010, *Guidance on Social Responsibility,* was published as a guidance standard for social responsibility (ISO 2010).

It does not matter whether an organization has a foundation based upon sustainability or social responsibility; what is important is to understand that both are similar strategies, often with overlapping goals. By virtue of its seniority and its United Nation's origin, sustainability is probably best thought of as the umbrella for all succeeding initiatives, making CSR one part of an overall approach for attaining sustainable growth.

If sustainability or CSR is not important in your organization, it is safe to assume that the concept of continuous improvement is. Any organization desiring to meet strategic future challenges must have a culture and systems that drive improvement in all facets of the business.

SIDEBAR

ISO 26000 Content List

(ISO 2010)

The content of ISO 26000 is structured as follows:

Foreword

Introduction

1 Scope
2 Terms and definitions
3 Understanding social responsibility
4 Principles of social responsibility
5 Recognizing social responsibility and engaging stakeholders
6 Guidance on social responsibility core subjects
7 Guidance on integrating social responsibility throughout an organization

Annex A – Voluntary initiatives and tools for social responsibility

Annex B – Abbreviated terms

Bibliography

Green Environment

Green is typically associated with any form of environmental initiative to reduce adverse impacts to the planet. It is sometimes used interchangeably with sustainability. However, green is only one of the three legs of sustainable growth. A significant amount of work and effort is required to link environmental efforts with sustainability. For that reason, this chapter will not repeat what is widely available in publications and on the Internet. However, lean and green are aligning with little mention of safety (Taubitz et al. 2010).

Integration of Safety and Continuous Improvement with Sustainability

Safety

It has already been noted that safety is seen as a small part of sustainability and GRI. Because CSR is also a broad initiative emulating sustainability, safety is therefore viewed as a small part of social responsibility. Social responsibility efforts are often focused *outside* the workplace. Employee safety is rarely, if ever, mentioned in articles and publications that deal with sustainability and corporate social responsibility.

Without safety, the people part of sustainability is missing its core, but this is not well recognized. Baxter International, Inc., is an example of a company that has integrated safety into its sustainability strategies. The case study on Baxter International, Inc., outlines the safety and health performance metrics reported in the Baxter "2009 Sustainability Priorities Report" (Baxter 2010a).

Continuous Improvement: The Bridge

The bridge between dealing with the tactical issue of employee safety and the strategic goal of sustainable growth is depicted in Figure 2.

FIGURE 2. Bridge from safety to sustainability with continuous growth *(Source: Adapted from model by Taubitz)*

Continuous improvement (CI) or *continuous improvement processes* (CIP) are ongoing efforts to improve products, processes, and services. Process management, project management, and quality management are all tools that businesses use to drive continuous improvement. The following section of this chapter provides more detail on comparing strategic and tactical continuous improvement.

Many companies, large and small, are working on the somewhat nebulous issue of sustainability. Even if the term itself is not used, the concept of balancing people, the planet, and profit to achieve long-term success makes sense. Concurrently, leaders everywhere are faced with creating an organizational culture and processes that drive continuous improvement and the opportunity to stay in business for the long term.

Strategic and Tactical Continuous Improvement

Strategic continuous improvement is an ongoing effort to improve products, services, or processes. These efforts can seek *incremental* improvement over time or *breakthrough* improvement all at once. Delivery (customer-valued) processes are constantly evaluated and improved in the light of their effectiveness, efficiency, and flexibility.

CASE STUDY

Baxter International, Inc.

Baxter International, Inc., is working to integrate worker safety performance into its overall sustainability strategies and priorities. With approximately 49,700 employees in 27 countries and gross sales of $12.6 billion in 2009, Baxter International, Inc., and its subsidiary companies manufacture and distribute medical devices, pharmaceuticals, and biotechnology products in 100 countries (Baxter 2010a).

Robert L. Parkinson, Jr., Baxter's Chairman and Chief Executive Officer (June 2010) highlights workplace safety and health, injury, and illness performance, as well as environmental achievements, in Baxter's "2009 Sustainability Priorities Report." The report states that one of Baxter's priorities is to "promote a safe and healthy workplace" (Baxter 2010c). To do this, Baxter has set a 2015 goal to "implement best-in-class programs designed to protect the safety and improve the health of employees that result in performance in the top three industry peers" (Baxter 2010a). This demonstrates Baxter's recognition that occupational safety and health performance is integral to its sustainability strategy and is reflected in its commitment to performance reporting and peer benchmarking. A 2008 ORC benchmarking study ranked Baxter fourth among twelve reporting healthcare companies in days-lost rate performance (Baxter 2010a).

For worker safety and health performance, Baxter primarily reports in the area of injury/illness incident statistics: recordable case rate, cases with days-lost rate, days-lost rate, and restricted days rate as shown in the following table (Baxter International, Inc. 2010a, 2010b).

Lost-cay case rate	0.15 (21% improvement)
Days-lost rate	4.16 (2% Improvement)
Restricted days rate	12.68 (35% improvement)
Recordable case rate	1.07 (17% improvement)
Employee/contractor serious incidents*	12/2
Employee/contractor fatalities	0/0

*A serious workplace incident case "results in an employee or contractor being hospitalized overnight, sustaining an amputation or dying"

According to Baxter, it has realized improvements in its incident rates over the previous year in all areas, with the exception of serious incident cases. According to the ORC report, the company proactively recognized this exception and is assessing the root causes of these serious incidents to prevent potential reoccurrence in the future (Baxter 2010a).

In addition to injury/illness incident statistics, Baxter is also focused on two areas of leading performance metrics: hazard identification and risk assessment (HIRA) and near-miss reporting. Baxter has identified ergonomic risk as a key focus area for its operations globally. To that end, the company has used a risk-based approach (HIRA) to reduce its manual handling-related injuries—11 percent in one year at its Castlebar, Ireland, facility (Baxter 2010a).

The second leading performance indicator used by Baxter is adoption and implementation of a near-miss reporting initiative. By the end of 2009, Baxter reported that 64 percent of its manufacturing, research and development, and distribution sites (more than 100 employees) had implemented this initiative. Baxter's manufacturing site in Cleveland, Mississippi, has seen an 89 percent increase in near-miss reporting since the initiative was implemented there in 2006 (Baxter 2010a). Near-miss reporting allows for incident investigation, root cause analysis, and implementation of control methodologies to prevent reoccurrence of a future near-miss incident or potential injury or illness as a result of the same incident root cause. According to Baxter, this will be an ongoing leading indicator of sustainability performance (Baxter 2010a).

For their 2009 sustainability performance, Baxter International. Inc. was ranked 20th out of America's "100 Best Corporate Citizens" by *Corporate Responsibility (CR) Magazine (CR Magazine* 2010). The company has also been recognized as one of the "Global 100 Most Sustainable Corporations" since the list was first published in 2005, has been listed on the Dow Jones Sustainability Index since its launch in 1999, and has been named Medical Products Industry Leader for nine years (Baxter 2010b).

In the experience of author Taubitz, five key criteria for continuous improvement processes include:

1. A core principle of CIP is the (self) reflection of processes (*feedback*).
2. The purpose of CIP is the identification, reduction, and elimination of suboptimal processes (*efficiency*).
3. The emphasis of CIP is on incremental, continuous steps rather than giant leaps (*evolution*).
4. Respect for people is the basis for including everyone in continuous improvement efforts *(empowerment and engagement).*
5. The more strategic elements include deciding how to increase the value of the delivery- process output to the customer (*effectiveness*) and how much flexibility is valuable in the process to meet changing needs.

CASE STUDY

COMAU Inc.: Coping Machine Project Summary—X-Mation Facility (Megan Raines 2009)

This situation involved a metalworking machine which did not have a guard to protect operators from hand/finger injury during machine operation. *(Note:* thankfully, no such injuries had been sustained.) The machine could perform various functions, including coping, and was being used for coping various sizes of angle iron stock. It was actuated using a guarded foot pedal. Upon actuation, the top portion of the machine moved downward to cope the stock. When the point of operation of the machine was opened, it exposed a gap approximately two inches high and several inches wide and deep under the moving area (Figure 3).

In the past, a guard had been added, but it blocked the point of operation, which prevented the machine from being used. Thus, the guard was only in place when the machine was not in use and did not protect the operators. Other protections had been discussed but were not feasible due to the design of the machine. For example, two-hand controls could not be installed because the operator needed to hold the stock in place during operation for safety and quality reasons. The guard the manufacturer could provide was a sliding guard that had to be moved to expose the point of operation prior to using the machine, which was determined to provide inadequate protection for this task.

On both sides, the machine had a guide to help properly position the stock. The guide was adjustable to allow for different stock sizes. The guide did not have preset locations for the different stock sizes—the operator would have to know exactly where to position the guide during adjustment. Changeover required use of hand tools and four different adjustments. Total changeover time was approximately fifteen minutes.

During operation, the operator had to firmly hold the stock close to the point of operation, to ensure that the stock did not move during machine operation (Figure 4). When the stock moved, it caused quality problems with burrs on the stock, which required rework to correct and thus added cost. If the stock was not held, it could be ejected from the machine, thereby exposing the machine operator to injury. Repetitive holding of the stock in this manner introduced ergonomic risk factors.

The main goal of the project was to design appropriate guarding for the machine to prevent risk of an injury. A requirement of the design was that it would not negatively impact the productivity or quality of the operation. Operator input for the design was sought to ensure compliance and satisfaction with the result.

With support from management and safety personnel, the machine operator personally developed a design for a guard that met all of the project goals. The guard was manufactured in-house for very little cost. Photos of the new guard were sent to the machine manufacturer, who approved Comau's use of the guard.

The two-piece guard was permanently installed in front of the point-of- operation area. The guard completely prevented the operator's hands/fingers from entering the hazardous gap area, virtually eliminating the risk of a finger/hand injury (Figure 5). The guard allowed the edge of the stock to slide underneath it to enter the machine.

The new guard had two preset settings for stock of different sizes. Changeover required a simple hand adjustment in two locations, which took 30 seconds or less in total. During

FIGURE 3. Before: point of operation configuration creates injury risk *(Source:* COMAU Inc. 2009)

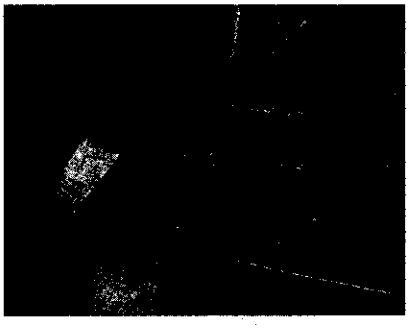

FIGURE 4. Before: operator has to hold stock *(Source:* COMAU Inc. 2009)

operation, the operator would slide the stock into the guard. Because of the design allowing the two sections of guard to work together, the guards would guide the stock into proper position each time without the operator needing to make adjustments. The stock was held in place by the guards and no longer needed to be held by hand during operation, which eliminated an ergonomic risk factor (Figure 6). Because of the ease of use and stock positioning, productivity improved by over 15 percent. Because the stock cannot move around during operation, quality was improved and the need for rework was eliminated.

All of the goals were accomplished and exceeded during this project.

FIGURE 5. After: point of operation no longer exposed *(Source:* COMAU Inc. 2009)

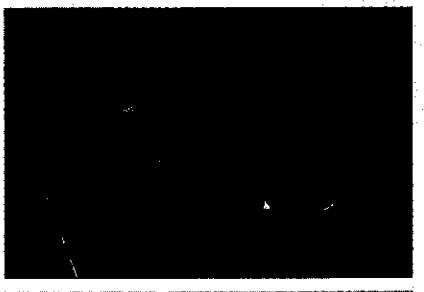

FIGURE 6. After: operator no longer holds stock during operation *(Source:* COMAU Inc. 2009)

The risk of injury due to the gap was virtually eliminated, while productivity, quality, ergonomics, and changeover time were also significantly improved. The machine operators were fully involved in the solution and are very happy with the result. Projects such as this demonstrate and uphold Comau's commitment to the health and safety of its workers.

Examples of continuous improvement tools and processes include the following (Taubitz):

- problem solving
- brainstorming
- cause-and-effect diagrams
- check sheets
- flow diagrams

Lean thinking and Kaizen events are developed around the concept of identifying and eliminating waste. The seven forms of lean waste are:

1. Correction
2. Overproduction
3. Motion (people)
4. Material movement
5. Waiting
6. Inventory
7. Process

These make up the acronym COMMWIP, which is a useful way of remembering wastes that negatively impact operational performance. When considered with the wastes of safety (injury and illness) and environmental wastes (air, water, solids, energy, and so on), it is possible to view things in a new light, one that allows the best approach for achieving sustainable growth. A new goal of achieving acceptable risk (safety and environment) with minimized (lean) operational waste fosters daily decisions that contribute to the triple bottom line.

The Kaizen approach from lean manufacturing is another tactical CI tool. Kaizen efforts are small, incremental steps that employ other tools in addition to those cited above. Based upon the experience of author M. Taubitz, Kaizen tools (often associated with lean tools and thinking) are simple and designed to empower and engage the entire workforce, including:

- 5S
- value-stream mapping
- A3 and one-page reports
- knowledge folders
- standardized work

NOTE: 5S is a simple five-step process to sustain the workplace as clean and organized. A3 reports are a standardized approach used for communication and problem solving.

According to Taubitz, examples of a Kaizen approach include:

- Improvements are based on many small changes rather than on radical changes that might arise from research and development (R&D) and project efforts.
- Since the ideas come from the workers themselves, they are less likely to be radically different, and therefore easier to implement.
- Small improvements are less likely to require major capital investment than major process changes.
- The ideas come from the talents of the existing workforce, as opposed to using R&D, consultants, or equipment, any of which may be very expensive.
- All employees continually seek ways to improve their own performance.
- Workers are encouraged to take ownership for their work and can help reinforce working

in a team, thereby improving overall worker motivation.

Particular attention should be paid to problems associated with process, including:

- too many steps/unnecessarily bureaucratic
- no process, allowing work to be performed that may not be safe or in line with best practice
- process not understood by those who perform the work
- not inclusive of all issues

This latter point is key for safety, health, and environmental professionals. Risk assessment that does not balance safety, environment, and operational performance is likely to suboptimize one leg of the triple bottom line at the expense of the others. Case studies will prove that overall performance is negatively impacted in such instances.

Some see continuous improvement inherently intertwined with management systems. Processes, such as business process management, quality management, and project management, are all part of the strategic toolkit. Deming saw it as part of the system whereby feedback from the process and the customer were evaluated against organizational goals (Deming 1982). W. Edwards Deming's Plan-Do-Check-Act (PDCA) is the foundation for management systems and continuous improvement (Deming 1982):

- ***Plan:*** Identify and analyze the problem
- ***Do:*** Pilot/implement the planned change
- ***Check:*** Analyze results and modify or plan for full implementation
- ***Act:*** Introduce systemic changes and training

The fact that this can be called a management process does not mean that it needs to be executed by management, merely that it makes decisions about the implementation of the delivery process and the design of the delivery process itself. Plan-Do-Check-Act (PDCA) is the foundation for ANSI/AIHA Z10:2005, *Occupational Health and Safety Management Systems* (ANSI 2005) and is also central to ISO 9000:2008 (ISO 2008), ISO 14000 (ISO 2004), and OSHA's Voluntary Protection Program (VPP) (OSHA 2009) are other examples of management systems that will drive continuous improvement.

A Management System

Though continuous improvement (CI) comes in many forms for different organizations, it is often associated with a management system to drive continuous improvement. CI can provide a foundation for the organizational culture and the goal of zero injuries—identical to the goal of zero defects—and it includes everyone in the desired

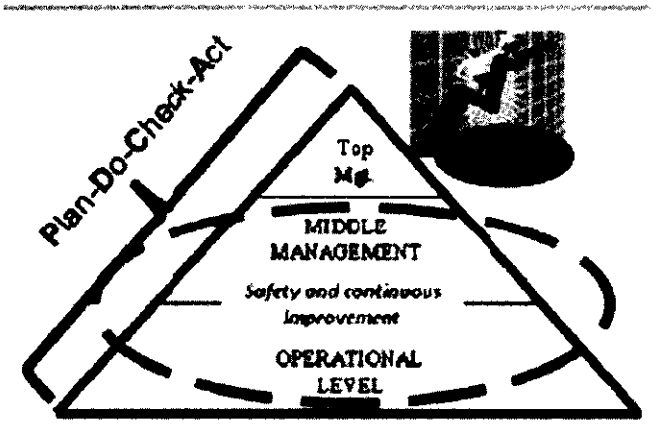

FIGURE 7. Management system based on Plan-Do-Check-Act *(Source:* M. Taubitz, adapted from the Lean & Safe Network 2008)

transformation. Achievement of zero defects and zero injuries demands both responsibility and accountability, which is where a management system based on PDCA comes into play (see Figure 7).

A management system is nothing more than a tool for leaders to drive continuous improvement. Goals and objectives are established to accomplish or achieve improvements. Planning and implementation allow for integration into the day-to-day business. Audits, metrics, and evaluation are part of the checking processes that indicate where system adjustments should be made (act) to further reduce injuries (defects). A management system is a series of processes that allows leaders to define responsibility and hold people accountable.

The philosophy of continuous improvement, driven by root-cause analysis of problems, fits perfectly with safety. Use of continuous improvement tools and thinking paves the way for continuously improving safety on and off the job.

Learning to associate integrating safety into continuous improvement will lead the organization to a new way of thinking. Attitudes improve and behaviors change accordingly.

Legislation, Standards, and Market Influences

International Influences and Regulations

There are several influences that are driving organizations and governments to reduce their greenhouse gas (GHG) emissions and focus on their sustainability strategies. These include international protocols; United Nations Conventions; European Union GHG regulations; carbon trading markets; and instruments used by the investment community that reports on an organization's

environmental, social, and governance (ESG) sustainability performance. These instruments include, but are not limited to, the *Carbon Disclosure Market, Dow Jones Sustainability Index* (DJSI), and *MSCI Inc.* These factors have a global reach and impact U.S. organizations. Safety professionals who understand the external financial, voluntary, and regulatory forces that are driving sustainability within their organizations are better able to align safety and health management within the context of the greater dialogue on sustainability. The following provides a brief overview of some of these influences to familiarize the reader with terminology and concepts.

Kyoto Protocol

The Kyoto Protocol is an international agreement that, among other things, sets out binding targets for 37 countries and the European Union to reduce greenhouse gas emissions. Adopted on December 11, 1997, in Kyoto, Japan, it became effective in February 2005, and is linked to the United Nations Framework Convention on Climate Change (UNFCCC). These targets amount to an average of 5 percent reductions from the 1990 emission levels over a 5-year period from 2008-2012 (UNFCCC 2010b).

There is a significant distinction between a *protocol* (e.g., Kyoto) and a *convention* (e.g., UNFCCC or UN labor conventions). In the case of GHG emissions, the UNFCCC convention *encourages* industrialized countries to stabilize their GHG emissions, while the Kyoto Protocol *commits* them to do so.

Under the Kyoto Protocol, countries are expected to meet their targets through GHG emission-reduction strategies; however, the Protocol also offers countries an ability to meet their targets through three market- based mechanisms (UNFCCC 2010b):

- ***Emissions trading:*** Known as "the carbon market," this allows countries with emission units (permitted to them) they have not used to sell their excess emission units to countries that are over their emission targets (UNFCCC 2010a).
- ***Clean development mechanism (CDM):*** Allows a country to implement an emission-reduction project in developing countries to earn saleable, certified emission-reduction (CER) credits (equivalent to one ton of CO_2). This can be counted toward meeting their Kyoto targets.
- ***Joint implementation (JI):*** Allows a country to earn emission-reduction units (ERUs) from a joint emission-reduction or emission-removal project with another country also covered by the Kyoto Protocol. The ERU is equivalent to one ton of CO_2, which can be counted toward meeting the first country's Kyoto target. The rationale is that the CO_2 emissions overall are being reduced globally, and this mechanism benefits the developing country through foreign investment and technology transfer.

Safety professionals who understand the overall business of carbon trading and what influences their country and organization's decisions in the United States and around the world are better positioned to influence their organization's sustainability strategies for energy and CO_2 reductions. Reducing GHG emissions, whether by implementing processes to reduce energy consumption or reducing CO_2 emissions directly, often impacts safety and health (OSH and product end users) and should to be considered in the design and implementation of these new reduction strategies.

Copenhagen Accord

Representatives from over 190 nations met in Copenhagen to discuss the future of global climate change. The meeting, which produced the *Copenhagen Accord*, was held in conjunction with the United Nations Framework Convention on Climate Change (UNFCCC 2009c). Signing the Copenhagen Accord did not impose any legal requirements or targets on a country, but the country agrees to work to achieve its GHG emissions goals. The signatories of the Accord included countries such as the United States, China, India, Brazil, the European Union (27 countries) and others, accounting for 86 percent of global emissions according to the Climate Action Network's calculations (Broder 2010). The next global climate summit, known as the Conference of Parties (COP) was held in November 2010 in Cancun, Mexico.

European Union Emissions Trading System (EU ETS)

The *EU Greenhouse Gas Emissions Trading System* (EU ETS) is a worldwide system that began in January 2005. The EU ETS is based on the requirements set out in the EU Emissions Trading Directive (Directive 2003/87/EC), which became effective in October 2003 (EU Commission 2010). The system tracks GHG emissions by country and the individual entity owning the emission unit.

The EU ETS is overseen by a central administrator at the EU level, but the accounts in electronic registries are set up by each EU member state. The registry system tracks the ownership of emission allowances in the same way the banking system tracks the ownership of money (EU Commission 2010). This trading system is one of the first carbon markets.

CARBON DISCLOSURE PROJECT (CDP)

The Carbon Disclosure Project (CDP) is a UK-based, global climate-change reporting system. Over 3000 organizations in approximately 60 countries measure their greenhouse gas emissions and disclose their climate-change strategies through the CDP (CDP 2010). This disclosed information is used by institutional investors, corporations, policymakers and their advisors, public-sector organizations, government bodies, academics, and the public. CDP has shaped the harmonization of climate-change data and has significantly influenced the development of international carbon-reporting standards.

According to their Web site, CDP acts on behalf of 534 institutional investors, holding $64 trillion in assets under management, and some 60 purchasing organizations, such as Cadbury, PepsiCo, and Walmart (CDP 2010).

It is important to understand that these socially responsible investors are influencing organizations around the world to develop CO_2 reduction strategies. The designing of processes to implement these strategies can have a direct impact on the work of the safety professional, whose job it is to assure the safety and health of the workforce involved in these processes. Additionally, understanding and anticipating how these various influences are impacting business decisions in an organization, the safety professional is better able to proactively identify new business opportunities, such as new products and services, process improvements, and mitigating OSH and CO_2 implications for product end users, which enhances the marketability of the product.

Dow Jones Sustainability Index (DJSI)

The Dow Jones Sustainability Index (DJSI), derived from the Dow Jones Global Index (DJGI), benchmarks and tracks the financial performance of the leading sustainability-driven companies on a global basis. The DJSI is used by the investment community to identify and select companies for investment purposes based upon their sustainability performance.

The DJSI tracks the financial performance of 57 sectors out of the 2500 in the DJGI, and reports on the top 10 percent in those sectors in the areas of social, economic, and environmental performance (DJSI and SAM 2010); specifically, it defines what a company's business strategy is and how it identifies its risks and opportunities around sustainability.

Sustainability asset management (SAM) is the investment group that manages the DJSI. It provides assessment information on a company's corporate sustainability performance based upon a set of questions. The results of the assessment determine whether the company will be listed on the index. According to the DJSI Web site, SAM measures a company's strategy, financials, customer relationships, product sustainability, corporate governance, stakeholder engagement, and human resource management (DJSI and SAM 2010).

MSCI Inc.

MSCI USA Broad Environmental, Social, and Governance (ESG) Index provides ESG performance information for the investment community, including asset managers, banks, hedge funds, and pension funds (MSCI Inc. 2010). According to the MSCI Inc., the following criteria are used to rate companies: management of environmental challenges; impacts on communities, employees, contractors, and suppliers (antidiscrimination, labor-management, employee safety, and labor rights) throughout the supply chain; product quality; regulatory compliance; investor relations; board accountability; business ethics; and governance around management, financial, and sustainability reporting practices (MSCI Research 2010).

National Regulations and Initiatives

With sustainability, waste reduction, and energy efficiency becoming more desirable characteristics within communities, national and local initiatives have been developed to address this need and to promote the changes necessary to foster responsible use of natural resources.

The first U.S. government legal initiative toward promoting sustainability was the National Environmental Policy Act (NEPA) of 1970, which laid out the national goal of creating and maintaining sustainable conditions for future generations of Americans (EPA 1970).

The U.S. Environmental Protection Agency (EPA) oversees a number of sustainability regulatory programs, including those involving transportation fuels, fuel economy, and greenhouse gas emissions.

Transportation Fuels

The Energy Policy Act of 2005 (EPA 2010c) and the Energy Independence and Security Act of 2007 (EPA 2010c) authorized the EPA to create standards requiring transportation fuels to contain a minimum amount of renewable fuel content, and to encourage production and use of renewable fuels while reducing dependence on foreign energy sources. The resultant renewable fuels standard (RFS) sets minimum volumes of renewable fuels, such as ethanol, to be incorporated into the nation's transportation fuel supply (EPA 2010c).

Fuel-Economy Standards

The EPA provides annual automotive fuel-economy data for several federal agencies, including the Internal

Revenue Service (IRS), the U.S. Department of Transportation (DOT), and the U.S. Department of Energy (DOE) (EPA 2010a). Among its many uses, the data is displayed on stickers for new vehicles sold in the United States, informing potential consumers about a vehicle's fuel efficiency. Fuel-economy standards for cars and light trucks are continually updated, driving increased efficiency and reduction in fuel use in the U.S. economy.

In January 2007, President Bush signed Executive Order 13423, "Strengthening Federal Environmental, Energy, and Transportation Management" (EPA 2007). The order requires all federal agencies to carry out their missions in a sustainable and energy-efficient manner and to set goals for continuous improvement (EPA 2007).

Greenhouse Gas Emissions Standards

On May 7, 2010, the EPA, in cooperation with the National Highway Traffic Safety Administration (NHTSA), issued the first greenhouse gas emissions standards for manufacturers of light-duty vehicles (EPA 2010g). The standards, which establish limits for carbon emissions in cars and light trucks, start in 2012 and extend through 2016 (EPA 2010g). Similar standards for heavy vehicles are proposed.

Economy, Energy, and Environment (E3) Sustainability Efforts in Manufacturing

Those occupational safety and health (OS&H) professionals looking for ways to capitalize on linking lean manufacturing principles with sustainability initiatives will benefit from the EPA's *Economy, Energy, and Environment (E3) Initiative.* E3 is a coordinated federal and local technical assistance initiative to help manufacturers adapt and thrive in a new business era focused on sustainability. According to the EPA (EPA 2010d), the program provides technical assessments of production processes and training in four key areas:

- lean
- clean
- energy
- greenhouse gas emissions

Depending on the processes of a company, large or small, there are assessments and training target opportunities to:

- maximize energy efficiency
- reduce environmental wastes
- identify opportunities for reducing carbon emissions
- promote sustainable manufacturing practices and growth
- reduce business costs

The EPA offers support to interested companies by providing assistance with:

- a *lean review* that leads to increased productivity and reduced costs
- an *energy audit* that provides tools and insights for reducing energy demand and costs
- a *greenhouse gas evaluation* that teaches manufacturers how to calculate GHG emissions and evaluate reduction strategies
- a clean review that results in water and energy conservation, reduced emissions, and additional cost savings
- *postassessment recommendations* that guide each facility toward improvements in overall efficiency; reduced waste; more efficient use of resources, including energy and water; and cost savings

PILOT PROJECTS

In Columbus, Ohio, six companies participated in an E3 pilot that identified energy savings of $1.7 million and environmental savings of $2.6 million, avoided over 250,000 pounds of water pollutants, and reduced solid waste by 24,000 pounds (EPA 2010d).

E3 is currently completing two pilot projects. In Columbus, Ohio, federal partner agencies are coordinating to conduct technical assessments and provide training by working with six manufacturers, the city government, the Solid Waste Authority of Central Ohio, and American Electric Power. In San Antonio, Texas, the EPA, the Department of Commerce, CPS Energy, and the city government are working with six manufacturers.

The E3 partnership in San Antonio, Texas, resulted in a local manufacturer of detention equipment realizing increased energy efficiency that included $85,000 in energy savings, reduced annual electric consumption of 159,000 kwh, reduced monthly electric demand of 48 kW, and reduced annual natural gas usage of 36,000 CCF.

State and Local Sustainability Initiatives

A number of U.S. states have initiated sustainability programs and requirements without prompting from the federal government. For example, the state of California was granted a waiver of Clean Air Act preemption in 2009 to establish its own light-duty vehicle GHG emission standards. The standards were scheduled to start with model year 2009, but are currently undergoing a regulatory review process (Cal EPA 2007).

The Oregon Sustainability Board works to promote sustainable business practices within Oregon state government. One example is statewide Policy 107-011-140, also known as Sustainable Procurement and Internal

Operations. The policy sets high sustainability standards for purchases and the disposal of electronics and related office waste; it also includes guidance for electronic distribution of meeting minutes, telecommuting, and audio/video conferencing instead of travel (Oregon DAS 2009).

The state of Washington has adopted a number of policies aimed at reducing GHG emissions from transportation, industry, use of buildings, and other sources (ECY 2010). A target of returning to 1990 GHG emission levels by the year 2020 is in place. Facilities emitting over 10,000 metric tons of greenhouse gases must submit an annual emission inventory report to the State Department of Ecology. Certain large employers must have a commute trip-reduction program in place to reduce energy use. A Green Economy Jobs Initiative looks to approximately triple the number of green jobs in Washington by 2020, as compared to a 2004 baseline (ECY 2010).

Sustainable Jersey®, a voluntary New Jersey initiative, was started in 2006 by a group of town mayors. It encourages local municipalities to become certified by implementing a series of sustainable management practices (SJ n.d.). The certification process involves implementing a series of environmental, cultural, and energy-efficiency improvements in accordance with a set of standardized best practices. Certification benefits include cost savings, access to ongoing state and local grant funding for sustainability programs, and a positive public image (SJ n.d.).

Similar to many U.S. states, local municipalities are establishing their own environmental and sustainability programs. For example, within New Jersey, the Princeton Environmental Commission provides counsel and guidance to its host municipalities, Princeton Township, and the Borough of Princeton. Made up of eleven voting community members from various backgrounds and professions, the commission drafts and reviews sustainability-based ordinances for its local governing officials and provides community educational opportunities in accordance with the Princeton Environmental Commission Mission Statement: "To inform local government and residents on environmental issues, laws, and programs" (Wasserman 2010).

Several of the commission's key projects include:

- proposing updates to land-use ordinances to include land preservation provisions
- drafting proposed green building provisions to local construction projects
- encouraging further local recycling efforts

Since its inception in 1977, the commission has provided progressive sustainability guidance to the Princeton community (Wasserman 2010).

U.S. Green Building Council (USGBC)

Prompted by the growing trend toward more efficient and sustainable building design, the U.S. Green Building Council (USGBC) was formed in 1993 as a means to provide measurable criteria for green construction. The organization has grown steadily to its current level of 30,000 members, united across 80 U.S. chapters (USGBC 2010a). The broad spectrum of professional members includes building owners, real estate developers, architects, and engineers (USGBC 2010a).

The USGBC has developed a number of tools to assess and promote green building: educational materials, outreach programs, national and local membership chapters, and the LEED® (Leadership in Energy and Environmental Design) Green Building Certification Program and LEED Green Building Rating System™ (USGBC 2010b). The Council also hosts the Greenbuild International Conference and Expo (Greenbuild 2010).

LEED® GREEN BUILDING CERTIFICATION PROGRAM

In 2000, the LEED® Green Building Certification Program was initiated. Under the program, architects and building owners can apply for and receive LEED® certification for the design and functionality of their green building project. The building project must take into account the entire life cycle of the building, from initial design through construction and end use (USGBC 2010f). The LEED® logo is shown in Figure 8.

Under the program, certification credits are awarded to a building project based on a number of critical areas, including (USBCG 2010f):

- sustainable sites
- water efficiency
- energy and atmosphere
- materials and resources
- indoor environmental quality

Point values for materials and other criteria are contained in a series of tables available from USGBC. From

FIGURE 8. LEED® logo *(Source:* USBGC 2010b. "LEED" and related logo is a trademark owned by the U.S. Green Building Council and is used with permission.)

the maximum of 100 possible points (plus up to 10 bonus points for a combination of innovative design and regional priority, where earned) for certain types of LEED® projects, a building project is rated (USGBC 2010f). Based on the cumulative total points earned, a project will be awarded one of the following LEED® certifications (USBGC 2010e):

- LEED® Certified
- LEED® Silver
- LEED® Gold
- LEED® Platinum

LEED® green building-certification rating systems include: homes, neighborhood development, commercial interiors (including core and shell for applicants responsible for a portion of a building project—their portion can become LEED® Certified), existing buildings, operations and maintenance facilities, schools, and healthcare and retail sales facilities (see Figure 9).

Applying for LEED® Building Certification

Once an individual or project team decides to pursue LEED® certification, a comprehensive registration package is sent to the Green Building Certification Institute (GBCI), the certification body of USGBC (USGBC 2010e). The decision to pursue LEED® certification should be made early in a project, preferably in the design phase, to allow material procurement, site selection and preparation, and waste handling to be managed for the maximum number of LEED® rating points.

Over 35,000 projects are LEED®-registered as of August 2010 (USGBC 2010f). Government agencies, such as the EPA, have set up green building programs for their new acquisitions or for agency remodeling projects based on LEED® registration. The program has resulted in the registration of a number of EPA buildings, including the EPA's Region I office (Boston, MA), Region IX office (San Francisco, CA), and Region X office (Seattle, WA) (EPA 2010e).

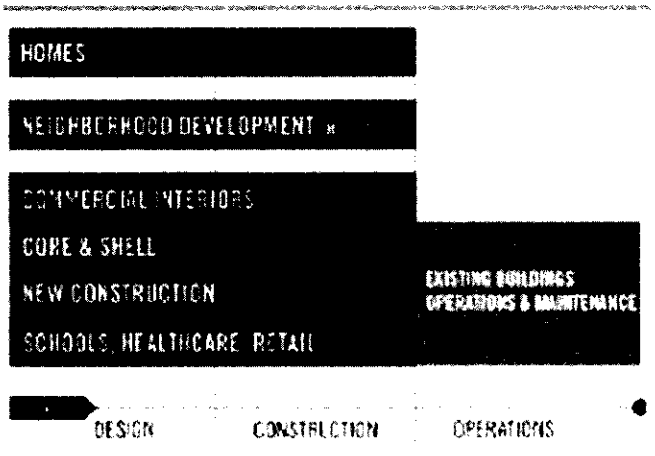

FIGURE 9. LEED® green building-certification rating systems (USGBC 2010f)

Individual LEED® Certification

Architects, engineers, environmental specialists, and other professionals can obtain certification in the administration of LEED® criteria through the LEED® professional certification program, administered by the GBCI (USGBC 2010f). Certification levels include:

- LEED® Accredited Professional (AP): This is the highest individual LEED® coordinator certification, representing a combination of experience, education, and successful written examination. Successful candidates are awarded the LEED® AP designation for use on individual promotional materials as an indicator of attained professional expertise in green building management. The certification is intended for technical professionals.

  Several specialty LEED® AP certifications are available, including ND (neighborhood development), Homes, O&M (operations and maintenance), ID+C (interior design and construction), and BD+C (building design and construction) (USGBC 2010c).
- LEED® Green Associate: This certification is for nontechnical individuals interested in documenting an attained knowledge of green building concepts, including building design and use (UGBC 2010d).

California Green Building Standards Code®

California is the first U.S. state to adopt sustainability-based building code requirements. The *California Green Building Standards Code®*, known as the CALGreen Code, with its final form appearing first in 2010, became effective in January 2011 (CALGreen Code 2010). The code is made up of the following chapters, each of which contains minimum building requirements for California establishments that meet certain defined criteria (CALGreen Code 2010, vii):

Chapter 1: Administration

Chapter 2: Definitions

Chapter 3: Green Building

Chapter 4: Residential Mandatory Measures

Chapter 5: Nonresidential Mandatory Measures

Chapter 6: Referenced Organizations and Standards

Chapter 7: Installer and Special Inspector Qualifications

Chapter 8: Compliance Forms and Worksheets

Appendices of Residential and Nonresidential Measures are also included

The code provides specific construction and renovation requirements for building owners once the applicable occupancy and governing state agency or agencies are determined. It regulates every newly constructed building in California (CALGreen Code 101.3).

Among the code's sustainability requirements are minimum standards for utility use and waste minimization. For example, during residential construction, water use must be reduced by 20 percent through installation of plumbing fixtures or fittings meeting code requirements (CALGreen Code 4.303.1). To minimize waste during residential construction, at least 50 percent of nonhazardous construction or demolition waste must be recycled or salvaged for reuse (CALGreen Code 4.408.1). Similar requirements exist for nonresidential construction.

Linking Safety to Social Responsibility

ISO 26000 outlines key principles for recognizing social responsibility efforts and engaging stakeholders in the process (see the sidebar above on page 21). The OS&H professional can use the structure of ISO 26000 to demonstrate the strategic role OS&H management plays in social responsibility. There are several areas where OS&H issues are directly and indirectly connected to social responsibility principles found in ISO 26000 (Knott 2010). These are discussed in the sections below.

Recognizing Unique Needs of Members of the Organization

Safety management often involves addressing the unique issues related to ergonomics, disabled workers, language barriers, cultural differences, young workers, and an aging workforce. These programs should be highlighted by the safety professional when demonstrating an organization's social responsibility efforts toward recognizing the unique needs of its workforce.

Employee Participation in Safety and Health Efforts

The need for employee participation is highlighted by several safety management systems, including ANSI Z10 (ANSI/AIHA 2005), OHSAS 18000 (20072008), and OSHA. According to OSHA (n.d.), employee participation can take several forms:

- participating on joint labor-management committees and other advisory or specific-purpose committees
- conducting site inspections
- analyzing routine hazards in each step of a job or process, and preparing safe work practices or controls to eliminate or reduce exposure
- developing and revising the site safety and health rules
- training both current and newly hired employees
- providing programs and presentations at safety and health meetings
- conducting accident/incident investigations
- reporting hazards to upper management and/or responsible parties
- fixing hazards within your control
- supporting your fellow workers by providing feedback on risks and assisting them in eliminating hazards
- participating in accident/incident investigations
- performing a pre-use or change analysis for new equipment or processes in order to identify hazards up front before use

Employee Participation in Health and Safety Management Systems

ANSI Z10, *Health and Safety Management Systems* (2005) also specifically itemizes effective employee participation, including a role in activities such as incident investigations, procedure development, health- and safety-related audits, training development, job safety analysis, and all aspects of the planning process. In organizations where social responsibility is already a goal of the organization, the OS&H professional should already be able to identify several activities within the organization that address employee involvement. Areas where employee involvement is lacking or hampered can be more easily implemented by demonstrating that they add value to the organization's social responsibility goals. Examples of obstacles or barriers to employee involvement include: lack of response to employee input or suggestions, reprisals (supervisory and/or peer), or any other forms of discrimination (ANSI/AIHA 2005).

Guidelines for Safety Committee Development

Social responsibility is part of sustainability, involves employees in an organization, and gives them a voice on safety issues. Safety committee development is another way to demonstrate direct employee involvement in the safety program while also satisfying another component of good social responsibility. Safety committees are voluntary in many organizations but may be required by company policy or local regulations. The state of Oregon requires safety committees for most employers. A checklist provided by Oregon OSHA is found in Figure 10 for those OS&H professionals interested in developing, implementing, and/or auditing a safety committee (OR-OSHA 2010).

Occupational Safety and Health
Safety Committee Evaluation Checklist

To Do	Done	Item
☐	☐	The safety committee is composed of an equal number of employer and employee representatives.
☐	☐	Employee representatives are volunteers or elected by their peers.
☐	☐	There are at least four representatives on the committee if the workplace has more than 20 employees-at least two representatives if the workplace has 20 or fewer employees.
☐	☐	The representatives elect the committee chairperson.
☐	☐	Representatives are paid their regular wages during safety committee training and meetings.
☐	☐	Employee representatives serve on the committee for at least one year.
☐	☐	Representatives' terms of service are staggered so that at least one experienced representative is always on the committee.
☐	☐	Reasonable efforts are made to ensure that committee representatives represent the company's major work activities.
☐	☐	The committee meets monthly except when representatives schedule quarterly workplace inspections.
☐	☐	Committee meetings follow a written agenda.
☐	☐	The minutes for each meeting are maintained for at least three years.
☐	☐	Minutes are available to all employees.
☐	☐	All reports, evaluations, and recommendations are included in the minutes.
☐	☐	Management has a reasonable time to respond in writing to the committee's recommendations.
☐	☐	The committee has a method for collecting and reviewing employees' safety-related suggestions and reports of hazards.
☐	☐	The committee assists management in evaluating and improving the workplace safety and health program.
☐	☐	The committee's quarterly inspection team follows a standard procedure for identifying safety and health hazards during its inspections.
☐	☐	The inspection team includes employer and employee representatives.
☐	☐	The inspection team documents the location and identity of workplace hazards.
☐	☐	The inspection team-or other persons designated by the committee-inspects satellite locations quarterly.
☐	☐	The committee has a procedure for reviewing the team's quarterly inspection reports.
☐	☐	The committee recommends to management ways to control hazards and unsafe work practices.
☐	☐	The committee makes recommendations to ensure all employees are accountable for following safe work practices.
☐	☐	The committee has a procedure for investigating workplace accidents, illnesses, and deaths.
☐	☐	Representatives understand the purpose of their safety committee and know how it functions.
☐	☐	Representatives have access to applicable occupational safety and health rules.
☐	☐	Representatives have received safety training for identifying workplace hazards and investigating accidents.

FIGURE 10. Oregon OSHA's sample safety and health checklist (OR-OSHA 2010)

Eliminating Workplace Hazards, Including Psychosocial Issues

There is broad recognition that the psychosocial environment at work can affect physical and mental health as well as organizational outcomes, such as work performance and effectiveness (NIOSH 2004). Psychosocial issues can include stress, posttraumatic stress, workplace violence, bullying, substance abuse, absenteeism, racism and racial/ethnic prejudice, sexism and sexual harassment, gender and racial discrimination, work-family integration and balance, and support for diversity in the workplace/workforce. A questionnaire developed to assess psychosocial issues within an organization is available online (Pejtersen 2010). The safety professional may be directly or indirectly involved with one or more psychosocial programs within an organization, yet all safety programs will address workplace hazard identification and abatement methodologies that can be correlated to sound socially responsible actions of the organization.

Two-Way Communication Regarding Safety and Health

Sound OS&H management requires commitment from all levels of an organization but, most importantly, from top management. Management leadership and employee involvement go hand in hand for safety success. In fact, top-management leadership and effective employee participation are crucial for the success of a safety management system (ANSI/AIHA 2005). Management provides the leadership for organizing and controlling activities within an organization. It provides the motivating force, resources, and influence necessary to embed safety as a fundamental value within the organization. In an effective program, management involvement also provides the means through which employees express their own commitment to safety and health for themselves and their fellow workers (OSHA 1989). The ANSI Z10 standard identifies management leadership as the first step toward a successful safety management system (ANSI/AIHA 2005). Since employee involvement is crucial, it is important to establish communication and trust between management and workers.

According to Manuele (2003), an organization's culture consists of its values, beliefs, legends, rituals, mission, goals, and performance measures, and its sense of responsibility to its employees, customers, and its community, all of which are translated into a system of expected behavior. The culture of an organization dictates the effectiveness of a safety management system. Petersen found that the culture of the organization sets the tone for everything in safety. "In a positive safety culture, it says that everything you do about safety is important" (Petersen 1966, 66). Consider this statement by OSHA: "The best Safety and Health Programs involve every level of the organization, instilling a safety culture that reduces accidents for workers and improves the bottom line for managers. When safety and health are part of the organization and a way of life, everyone wins" (OSHA 2002).

Worker's Rights Regarding the Economics of Safety

In 1986, OSHA issued a program evaluation profile (PEP) for their compliance officers to use when evaluating an employer's safety program (OSHA 1998). Although this compliance directive was rescinded, it serves as guidance in the evaluation of a sound employee training program. The OSHA PEP is available on the OSHA Web site. According to PEP, key indicators include (OSHA 2010):

- Knowledgeable persons conduct safety and health training.
- Training is properly scheduled, assessed, and documented.
- Training covers all necessary topics and situations, and includes all persons working at the site (hourly employees, supervisors, managers, contractors, part-time and temporary employees).
- Employees participate in creating site-specific training methods and materials.
- Employees are trained to recognize inadequate responses to reported program violations.
- A retrievable record-keeping system provides for appropriate retraining, makeup training, and modifications to training as the result of evaluations.

OSHA regulations contain more than 100 standards that include training requirements. OSHA has developed some voluntary training guidelines to assist employers in providing safety and health information, which are available on its Web site (OSHA 1998). These guidelines also provide employers with instructions needed for employees to work at minimal risk to themselves, to fellow employees, and to the public. A summary of the training guidelines (OSHA1998) lists areas designed to help employers:

(1) Determine whether a work-site problem can be solved by training
(2) Determine what training, if any, is needed
(3) Identify goals and objectives for the training
(4) Design learning activities
(5) Conduct training
(6) Determine the effectiveness of the training
(7) Revise the training program, based on feedback from employees, supervisors, and other workers

Social responsibility requires a balance among the three Ps: people, profit, and the planet. Social responsibility should impact the balance between economic decisions and issues related to worker safety and health from the perspective of the workforce. This starts with the OS&H professional linking safety initiatives with profits or demonstrating the business value of safety. ANSI Z10 states that (ANSI/AIHA 2005, 6):

> Organizations and the community may see additional benefits of implementing an OHSMS beyond the reduction of injury and illnesses. Some of these benefits may include: lowered workers' compensation costs, reduced turnover of personnel, reduced lost workdays, compliance with laws and regulations, increased productivity, improved employee health status, improved product quality, higher morale of employees, reduction or elimination of property damage due to incidents, reduced business interruption costs, and reduced impact on the environment due to incidents.

The benefits discussed above are the positive outcomes of an effective safety management system that senior management can see. The job of the OS&H professional is to paint the picture of success and obtain a commitment from management while the vision is fresh. This salesmanship is a means to achieve commitment to safety from management. A little salesmanship can integrate safety into the business model by illustrating incident and accident effects on production and profitability. Integrating the costs of safety into the business and demonstrating a return on investment has been identified and is still a major goal of the OS&H professional (ASSE 2007, ASSE/AIHA 2005). This puts safety into a language to which management, front-line supervisors, and even employees can relate. Unfortunately, many safety initiatives have a negative impact on the bottom line of an organization. In these circumstances, a safety initiative may lose priority within an organization due to its economic impact. Socially responsible organizations will weigh the benefits of an OS&H initiative based on its social and environmental impacts in addition to its effect on the bottom line. The savvy OS&H professional will utilize social responsibility principles involving employee rights in economic decisions as value added to the organization when a profit-based business case for a safety initiative is lacking. The OS&H professional must be able to make a case for safety when there is not a direct positive effect on the bottom line. Various aspects of social responsibility help demonstrate value to an organization interested in sustainability and social responsibility. Active OS&H programs that routinely involve employees in the decision-making process on workplace hazard reduction should be highlighted as examples of meeting this social responsibility initiative.

Health and Safety in an Organization's Value Chain

ISO 26000 (2010) defines a *value chain* as the entire sequence of activities or parties that provide (suppliers, outsourced workers, contractors) or receive (customers, consumers, clients, members, and other users) value in the form of products or services. Organizations have found that sustainability can be reached only through people (Nestle 2009). No other asset in an organization is as important as the people that contribute with their work to the organizational culture and goals. These organizations devote all the necessary energy and attention to protect employees, contractors, and any other people along the value chain, including suppliers, customers, and the public. Organizations can highlight social responsibility by requiring suppliers to meet minimum OS&H program requirements. This can include the procurement of products and services that have a reduced environmental impact, often referred to as a *green supply chain*. Organizations can also mandate OS&H compliance to standards higher than what is mandated by local regulations. Serious organizations will also perform audits of their supply chain's OS&H commitment.

Consumer, Product, and Product Life-Cycle Safety

Organizations often work to address environmental and social issues across a product's life cycle. For instance, Baxter International, Inc., (2010d) incorporates these issues from sustainable design and bioethics during research and development to efficient use of energy and materials during manufacturing and transport, appropriate product advertising and promotion, and, finally, responsible repair, refurbishment, and recycling at product end of life. The OS&H professional should be aware of how his or her organization addresses consumer alerts and product recall information as part of its overall social responsibility goals. This awareness should also extend to products used within one's own organization. Social responsibility should also include a system to make management and employees aware of product defects and recalls on products utilized by the organization.

Personal Protective Equipment

The use of personal protective equipment (PPE) is an important aspect of an organization's social responsibility obligations. However, regulations and best practices require organizations to address workplace hazards using a hierarchy of controls. The use of PPE must be a last resort for protecting workers from workplace hazards. Protective

SIDEBAR

The organization shall implement and maintain a process for achieving feasible risk reduction based upon the following preferred order of controls (ANSI/ASSE 2005):

A. Elimination
B. Substitution of less hazardous materials, processes, operations, or equipment
C. Engineering controls
D. Warnings
E. Administrative control
F. Personal protective equipment (PPE)

Feasible application of this hierarchy of controls shall take into account:

- The nature and extent of risks being controlled
- The degree of risk reduction desired
- The requirements of applicable local, federal, and state statutes, standards, and regulations
- Recognized best practices in industry
- Available technology
- Cost-effectiveness
- Internal organization standards

equipment is acceptable as a hazard control method under the following circumstances (ANSI/ASSE 2005):

- when engineering controls are not feasible or do not totally eliminate the hazard
- while engineering controls are being developed
- when safe work practices do not provide sufficient additional protection
- during emergencies when engineering controls may not be feasible

The ANSI Z10 standard expands upon the traditional hazard-abatement hierarchy of engineering controls, administrative controls, and personal protective equipment. The sidebar outlines the hazard- abatement hierarchy that is provided by the Z10 standard (ANSI/AIHA 2005, 16).

Use of PPE should address workplace hazards. Good social responsibility should include the use of PPE as part of the hierarchy of controls to protect workers.

Case Studies

Following are five case studies, showing how safety and sustainability principles are implemented in the business community.

CASE STUDY 1

Sustainability in Action at BMW Group

The Munich, Germany-based BMW Group encompasses 24 manufacturing facilities in 13 countries. The company traces its roots to the 1917 Bayerische Motoren Werke G.M.B.H., originally producing aircraft engines, and later motorcycles. Several acquisitions and management decisions led to the current focus on individual mobility, primarily through the production and marketing of premier luxury automobiles that include BMW, Rolls Royce, and MINI brands. The group continues to manufacture quality motorcycles and the Husqvarna brand of power equipment.

Sustainability Management

The BMW Group embraces sustainability in all of its operations and publicizes its commitment through the group's Sustainability Strategy Objective: to be the most sustainable company in the automotive industry. BMW Group's Chairman of the Board of Management, Dr. Norbert Reithofer, succinctly states the group's commitment to sustainability: "... Our aim is to actively shape the future. To achieve this, we are making sustainability an increasingly integral part of our value chain. Sustainability should be a defining principle of how we design our processes and procedures."

To manage its sustainability objective, the group developed three core units (see Figure 11).

The *Sustainability Board* is an internal advisory committee comprised of the Group's entire Board of Management. The Board meets regularly to set future benchmarks and to discuss progress on current sustainability initiatives.

The *Sustainability Circle*, comprised of one representative per division, develops opportunities and enhances crosscommunication throughout the Group. The Circle reports directly to the Sustainability Board.

Each functioning department works with the Sustainability Circle to implement the appropriate waste reduction and conservation initiatives needed to advance the program and to meet the Group's objective.

All BMW Group employees play a key role in implementing the sustainability program. Each has a responsibility to manage resources with the company's sustainability stakeholders and the Group's goals and objectives in mind.

Strategy and Organization

The BMW Group Sustainability Strategy covers all group operations and is a corporate principle of the organization (see Figure 12).

In 2009, the Group set a sustainability target and measures progress through a corporate scorecard. Sustainability in the supply chain is managed through a system of procurement procedures that are managed by specially trained employees. Potential suppliers are

carefully screened and audited for environmental and social responsibility. Suppliers and potential suppliers are provided with assistance as necessary to comply with the Group's policy.

The overall sustainability strategy of the BMW Group is demonstrated through reduced environmental impact and increased efficiency in all areas of production, their positive contributions to the surrounding communities, and the uncompromising quality and innovation provided to customers.

Environmental Impact of Its Products

More efficient vehicle emissions and fuel consumption are among the Group's top priorities in its mission to provide value to its stakeholders. The Group is currently conducting the largest field-test of electric vehicles worldwide, with the near-term goal of putting a sustainable, fully electric vehicle into production and distribution. A hydrogen concept car has also been tested in Europe and worldwide; the test scenario in Europe included 100 test vehicles and a series of hydrogen filling stations. Research is ongoing, with focus on liquid hydrogen storage.

With reduction in CO_2 emissions as a long-held corporate objective, BMW has also been successful in engineering vehicles that emit less CO_2.

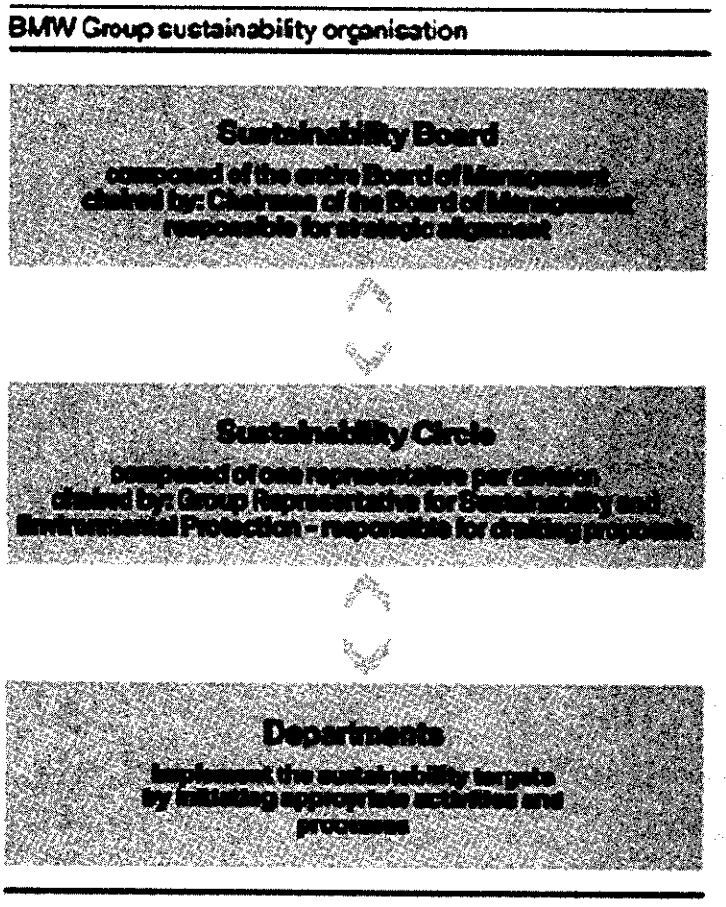

FIGURE 11. BMW Group Sustainability Organization (BMW 2008)

Also important are the life cycle of the vehicle itself and production efficiency. Approximately 95% of a new BMW vehicle can be recycled. Water use in the production process has decreased, as has the volume of waste, and volatile organic compounds per vehicle produced. Additionally,

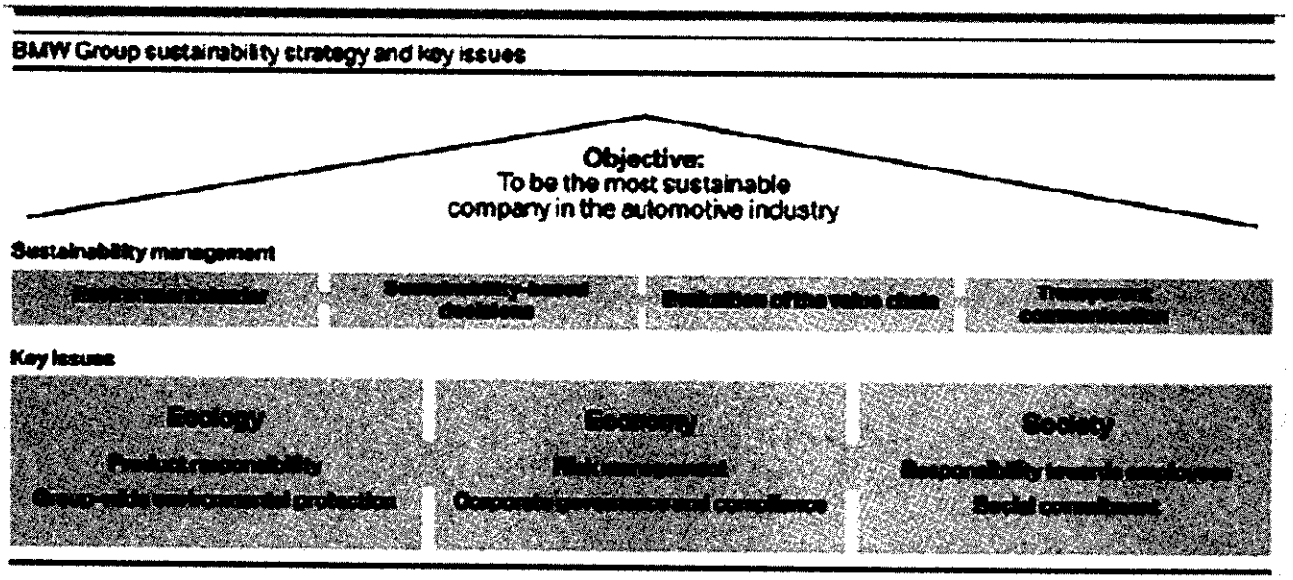

FIGURE 12. BMW Group Sustainability Strategy (BMW 2008)

in 2009 the Group's Spartanburg, SC, plant recycled 85% of plant-generated waste. Details of the Spartanburg plant's waste-handling in 2009 are shown in the table.

All of these innovations are done with the goal of minimizing the Group's use of resources in providing a valuable product to its customers.

2009 Waste (lb)	
Metal	5,030,731
Wood	2,441,280
Cardboard	4,199,280
Plastic	752,787
Glass	107,338
E-waste	34,528
Chemical	1,064,365
Hazardous	226,627
Special	1 7,970
Waste to landfill	2,433,220
Total 2009 Waste	16,308,126
Total recycled	85%
Total disposed	15%

(*Source:* www.bmwusfactory.com - Environmental Responsibility)

Sustainability and Safety

An integral part of the Group's sustainability initiative is the concept of employee health and safety. As with any safety-minded organization, a safe workforce is essential to the Group's success. To further improve performance, the Group has undertaken the goal of establishing occupational health and safety management systems at all locations. At the time of this writing, 50% of locations representing 80% of employees had fully operational systems in place in conformance with internationally accepted guidelines, such as OHSAS.

The remaining sites are scheduled to have systems in place by 2010. The focus on safety has improved the Group's accident frequency to 2.7 accidents per million hours worked, 33 percent less than the industry average of 4.0.

Initiatives for older workers, those with families or elderly relatives, as well as those with financial difficulties, are in place to enhance the overall well-being of BMW Group employees. The investment in these initiatives allows BMW employees to focus their efforts on efficient achievement of the Group's goals through outstanding performance.

Summary

Environmental and social responsibility simply governs the way the BMW Group conducts business. They do not consider sustainable operations as an option, but rather as a guiding principle that is integral to BMW's future success. In partnership with employees, customers, neighbors, and government, the Group is positioned to lead the automotive industry in sustainability and to succeed in its objective: to be the most sustainable company in the automotive industry.

CASE STUDY 2

Integration Failure: When Safety, Lean and Green Are Not Integrated (Bruce Main, September 2010)

Situation

A machine tool was cutting a metal part when the operator working adjacent to the machine heard a whooshing sound, flames shot out the finished parts' exit ports, the guard doors burst open, and he felt a sudden burning sensation on his arm and face. A flash of fire had erupted from ports of the machine. The operator suffered significant burns, resulting in severe pain, lost work time, and residual scarring.

Background

An investigation into the incident revealed a causal chain of factors. The flash fire was caused by a spark from the tooling. During the course of operation, heat and, occasionally, sparks are generated. The machining oil used to cool and lubricate the cutting operation was relatively benign in liquid form but flammable in a mist above a minimum concentration. During operation, an excessive concentration of airborne cutting fluid, which was in mist form, ignited. The mist concentration exce eded the machine tool supplier's recommendations at the time of the incident because the ventilation system did not provide adequate air flow. The air flow was inadequate because the machine user had installed a third machine on a two-machine system and tapped into the existing ventilation system without making adjustments for increasing the air flow. As a result, the ventilation system, designed for two machines, was inadequate to accommodate the requirements of a three-machine system.

Further investigation revealed that the machine was originally manufactured and sold in the 1980s. The machine supplier offered a fire suppression and mist control system with the machine proposal in the 1980s, but the customer "thrifted out" the fire suppression system at the purchase. The customer also opted to install the machine itself rather than pay for installation by the machine supplier. Historically, such systems and services are often resisted by some customers seeking to minimize the machine purchase price.

The machine was manufactured in Europe, shipped to the United States, and installed at the machine-user facility. The machine was rebuilt in the United States by the machine supplier in the early 2000s with updated control and ventilation systems. Prior to the incident, the customer installed the mist collection system.

Following the refurbishment, the machine supplier performed the startup and qualifying run of the

machine at the customer's facility. The qualifying run evaluated the ability of the machine to perform the necessary cutting operations within specifications and general operations of the machine.

More recent evolutions of this type of machine include fire suppression systems, ventilation systems, and interlock door switches on the doors. Following the incident, three new systems were installed on the machines: a retrofit ventilation system, a fire suppression system, and a mist collection system.

Hazards

A task-based, risk assessment of the system identified 145 task-hazard pairs. These hazards include both safety and environmental potential sources of harm, including the following hazards:

- cutting/severing from sharp edges of parts during normal operation
- slip and fall from cutting fluid dripping on the floor
- noise hazards
- environmental/industrial hygiene hazards of oil getting on parts and hands and airborne emissions from the enclosure
- a chemical allergen or irritant from the cutting fluid or, while reaching into the machine, cutting fluid dripping on neck or arms
- ergonomic hazards of posture when reaching into the machine with the doors
- hot surface temperatures from machined parts or motor surface temperatures
- pinch points between tooling in the machine or drive system
- fire from sparks from tool collision if the tooling is misinstalled or incorrectly moved or if the machine is not reset to accommodate new tooling
- crushing hazards during tool change or parts replacement
- fall hazards during parts replacements or filter changes while accessing the top of the machine
- pressurized lines if not locked out and energy released
- electrical hazards from energized equipment if not locked out during servicing
- fire hazard from heightened oil mist concentration; if fluid gets too low, the impeller can create an ignitable mist
- ergonomic hazards of lifting assemblies out of the machine
- environmental or fire hazards from hazardous waste of grease oils in rags
- environmental hazards of cleaning compounds and chemicals
- unexpected startup or motion if not locked out during servicing
- material movement hazards related to fork-truck delivery and removal of product
- hazards related to installation, hook up, and start up of machinery
- fire hazard of ignitable mist if the concentration exceeds the recommended maximum or the air flow is insufficient, or if the air intake is improperly located

Analysis

This case study highlights safety, environmental, fire, and operational hazards. The connection of a third machine to a ventilation system designed for two machines resulted in an unidentified hazard of inadequate ventilation and mist control. The ensuing fire and injury caused the company significant loss of production because the machines were unserviceable and required extensive repairs. The machines had to be sent to the U.S.-based service operations for repairs and updates.

Operational wastes that resulted from this incident include added:

- delay/waiting
- motion movement
- process

Additionally, several weeks' delay and significant costs were incurred by both maintenance operations and management personnel in dealing with the incident.

In addition, this case study highlights the challenges the machine supplier can encounter when a legacy machine it built many years ago is involved in injury incident, particularly if the residual risks associated with the older machine differ from those of the current product offerings.

Conclusion

The drive for the triple bottom line of sustainable growth requires that risk assessment concurrently address production, safety, and environmental risks. In this case, failure to address the environmental issue resulted in a significant safety issue, fire damage to equipment, and the consequence of lost production. All of the lean (operational) wastes (correction, motion/movement, and waiting), safety wastes (injury) and environmental waste (air contaminant) could be attributed to the seventh form of lean waste, process. Lack of a process that employed a fully integrated risk assessment overlooked a condition that caused pain, injury, and significant production and attendant costs.

CASE STUDY 3

Safety and Sustainability

A manufacturing company utilizes large vertical and horizontal boring mills to bore complex hole patterns into steel work pieces. Boring mills operate using "ways," which are essentially tracks that allow the body of the mill to move in three dimensions as needed based on the desired hole pattern. The ways are protected from metal chips by way covers, which adjust to the position of the body of the mill. The way covers require oil as a lubricant to ensure they slide correctly when the machine is moving. This oil drips off the ways over time, and this oil drip is inherent to the design of the machine.

At this company, the large boring mills are located in pits. In the original process, the excess oil would drip into the pit. Boring mill operators would then soak up the oil using oil absorbent, which was kitty litter.

The absorbent would build up over time until it was several inches deep in the bottom of the pit. Several times per year, the operators would scoop the absorbent out of the pit into collection drums using shovels. Once the absorbent was drained of all free liquids, the absorbent was placed into the general trash which would be sent to a landfill. The drained liquid would be reclaimed.

This process created a number of problems for both safety and sustainability:

- The amount of absorbent used greatly increased the amount of waste generated.
- Nearly all of the waste was being sent to the landfill, which did not support the company's sustainability goals.
- Operators who had to enter the pit to lubricate the machine would be subject to slip and fall hazards because of the unstable absorbent surface, as well as the oil, which would get into the soles of their shoes when inside the pit.
- The soaked kitty litter buildup resulted in an odor near the machine.

Additionally, the process of cleaning the pit was not lean and resulted in significant downtime, the absorbent buildup lowered employee morale, and its appearance did not impress visiting customers.

Therefore, machine maintenance personnel partnered with the safety/environmental department and machine operators to resolve these issues. A temporary fix was put in place as follows. First, the pit was completely emptied and cleaned. Then, absorbent socks were placed along the length of the way covers to contain the oil close to the machine. During this time, the oil in the socks could be squeezed out into drums and reclaimed. This eliminated the landfill waste. It also kept the pit much cleaner and ensured a stable walking surface when operators entered the pit. Additionally, it resulted in much less downtime for cleaning, and was visibly cleaner. However, the downside is that the socks needed to be replaced from time to time, and if they were not emptied soon enough the oil could leak into other areas of the pit.

Ultimately, a long-term solution was developed by the group. A small containment berm was built near the machine in a location that would not pose a trip hazard. When the oil builds up in the containment area, it can easily be pumped out for reclamation. The oil cannot leak into other areas of the pit. The only waste generated is the oil, which is reclaimed. This process significantly improved safety and sustainability for the machine. Productivity improved, while cleaning times decreased. The area looks visibly cleaner, and the employees working in the area are very appreciative. An added benefit is that the pit can now be swept with a broom to pick up metal chips generated by the boring process, and the chips can be recycled, which further improves sustainability. In the original process, the chips would mix with the kitty litter and be sent to the landfill.

The lesson learned is that safety and sustainability can often produce synergistic effects when both are considered together. Also, lean principles can also be applied when implementing safety and sustainability initiatives to improve other business priorities, such as productivity, while simultaneously improving safety and sustainability.

CASE STUDY 4

Safety and Sustainability

The challenge: Reduce safety and ergonomic risks along with cost and environmental impact of using disposable plastic wrapping material to protect parts shipped from a local supplier.

The previous method of wrapping and shipping the covers required annually:

- thousands of square feet of bubble wrap
- over a mile of tape to secure the wrap
- estimated labor and material costs exceeding $10,000

Cuts and complaints of sore wrists and hands were part of the process, along with significant amounts of material waste. Using lean tools and thinking, a team considered modifying the carts used to transport the parts. However, closer analysis suggested that every other part covered with a plastic sleeve would provide necessary protection while using half the material.The bubble wrap was eliminated.

Once removed, the plastic sleeves are returned to the supplier for reuse. Injuries from cuts and repetitive trauma problems were eliminated, and the environmental waste from scrap material was also eliminated. Operational costs were significantly reduced due to reusing the plastic sleeves, and faster performance of the task was achieved.

This real-life case study was driven by a desire to reduce injuries, which led to actions where people, the planet, and profit all won. These tactical steps in today's world are part of the journey to sustainable growth.

CASE STUDY 5

Safety and Sustainability

An automotive company had a significant amount of waste that was being sent to a landfill. The plant assembled a team to investigate methods to reduce the amount of waste being sent to the landfill and increase the amount of waste being recycled. This team included representation from the safety department.

One waste type the team identified for potential recycling was the wooden pallets and "pallet boxes" (pallets with corrugated cardboard containers stapled on the top). Previously, the pallets and pallet boxes had been crushed in a compactor and sent to a landfill. Not only was this very expensive, but it negatively impacted the environment and did not support the company's sustainability goals.

The plant began a process where the pallets were gathered and sent to a third party for reuse/recycling. The cardboard was removed from the pallet boxes by hand to allow the attached pallets to be sent to the third party. The safety department reviewed and approved the pallet box process based on the fact that packaging specifications required the cardboard on the pallet boxes to incorporate a "breakaway" feature to make it fairly easy to remove the cardboard by hand. Overall, the pallet recycling program saved the plant over $25,000 in the first year and significantly increased the overall percentage of recycled waste.

However, the process of removing the cardboard from the pallet boxes by hand was starting to cause ergonomic injuries to employees performing this task because of the amount of upper-extremity force necessary to pull the cardboard from the pallets. Additionally, it was a timeconsuming process and negatively impacted productivity. Although packaging specifications required specific "breakaway" features for the cardboard, some pallet boxes did not have this feature, and others were still too difficult to remove by hand, even with the breakaway feature. Various methods to alleviate the ergonomic risk factors were tested, such as using a powered hand saw and removing the cardboard using the forks of a forklift. However, these options presented other hazards.

Finally, a solution was developed that would alleviate or eliminate the ergonomic risk while still allowing the pallet box pallets to be recycled. First, the suppliers for all nonconforming pallet boxes were contacted to ensure the breakaway features were incorporated. Where possible, employees were allowed to manually pull off the cardboard from breakaway pallet boxes as long as the cardboard came off easily. For nonconforming boxes, and larger boxes where the cardboard was not easy to pull off, a different removal method was developed. A steel "shear plate" was installed directly above the compactor (and with the compactor manufacturer's approval). A forklift would pull the top of a pallet box across the shear plate to easily and quickly shear the cardboard from the pallet. The cardboard would then fall into the compactor and would be recycled. The pallet would be sent to the third party for recycling.

This new process resulted in a 100% reduction of injuries for this process and significantly improved productivity, while still allowing both components of the pallet boxes to be recycled. The lesson learned is that all potential safety hazards must be fully investigated prior to making a change to improve sustainability (or any other business priority).

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ADDITIONAL READING

DEVELOP AND SUSTAIN AN EFFECTIVE FLEET SAFETY PROGRAM – Z15 CAN HELP*

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Introduction

Millions of U.S. workers are at risk for a work-related motor vehicle crash (MVC). Fatality data show that across all industries, MVCs are consistently the leading cause of work-related fatalities. Of 43,025 work-related fatalities reported by the Bureau of Labor Statistics between 2003 and 2010, 10,202 were the result of single- or multiple-vehicle crashes of workers driving or riding in a vehicle on a public roadway, and 2,707 were pedestrian workers struck by a motor vehicle.[1,2] An analysis of the costs of MVCs to U.S. employers using data from 1998-2000 found that on average, each fatality cost a business over $500,000 in direct and liability costs, and each non-fatal injury cost nearly $74,000 (National Highway Traffic Safety Administration 2003). More recently, for MVC-related injuries requiring more than 6 days away from work, workers' compensation costs were estimated to be nearly $2 billion (Liberty Mutual Research Institute for Safety 2).

The risk of work-related MVCs cuts across all industries and occupations. Between 2003 and 2008, workers employed by truck transportation companies had the highest risk of work-related fatality due to an MVC while driving or riding in a motor vehicle on a public roadway (19.6 deaths per 100,000 workers), followed by logging (11.7), wholesale distribution of petroleum products (8.6), waste management services (8.5), and support activities for mining (7.9) (CDC 500). Heavy and tractor-trailer truck drivers account for the highest proportion of fatalities in any single occupation: 39% of the total for 2003-2010.[3]

The history and scope of the ANSI Z15.1 standard

The ANSI Z15 Committee was organized in 2001 to create a consensus standard with requirements for policies, procedures, and management processes for organizations to control risks associated with motor vehicles (ANSI/ASSE 2012 9). The American Society of Safety Engineers (ASSE) has served as the secretariat for the standard throughout its history. The first chairman of the ANSI Committee was Carmen Daecher, who served from 2001 until 2009, when he stepped down and William Hinderks was elected chairman.

The ANSI/ASSE Z15.1 standard, first published in 2006, sets forth practices for the safe operation of

[1] Source: Bureau of Labor Statistics online query system at http://data.bls.gov/cgi-bin/dsrv?fi

[2] From 2003-2010, there were an additional 2,487 worker deaths in crashes that occurred off a publicroadway or on industrial premises.

[3] Source: Bureau of Labor Statistics online query system at http://data.bls.gov/cgi-bin/dsrv?fi

organizational vehicles, defined as licensed vehicles designed to be driven primarily on public roads. The standard extends to use of this category of vehicles off public roadways. It provides organizations a template for development of policies, procedures, and processes to better manage the risks associated with vehicle use. ANSI/ASSE Z15.1 is applicable to organizations whose vehicles and drivers are covered by the Federal Motor Carrier Safety Regulations (FMCSRs) ("regulated" fleets), as well as to organizations whose vehicles and drivers do not operate under the FMCSRs ("non-regulated" fleets).

For organizations just beginning to formalize their vehicle operations safety program, the standard provides comprehensive guidance on what a program shall include, but leaves it up to the organization to design the specific detail based on their unique circumstances. For organizations with mature programs, fleet managers can use the standard to audit their existing program or provide a risk-based approach to fleet management.

It is important to point out that the field of vehicle risk management has evolved in recent years. ANSI/ASSE Z15.1-2012 was a moderate revision that includes more guidance in a number of areas (e.g., distracted driving) than its predecessor. Furthermore, the standard provides additional suggestions for measuring performance over time.

Basic Outline of ANSI/ASSE Z15.1-2012

The main body of the ANSI/ASSE Z15.1 standard is divided into seven major sections:

1. Scope, Purpose, Applications, Exceptions and Interpretations
2. Definitions
3. Management, Leadership and Administration
4. Operational Environment
5. Driver
6. Vehicle
7. Incident Reporting and Analysis

Each section of the standard is divided into two columns. The text in the left column contains requirements: what an organization "shall" do in order to be in compliance with the standard. The right column provides non-mandatory guidance and interpretation of the corresponding material in the left column. After the main body of the standard, the Appendices provide valuable supporting information and tools to help organizations apply the standard.

ANSI/ASSE Z15.1-2012 and Non-regulated Fleets: One Company's Experience

The ANSI/ASSE Z15.1 standard was intended to be applicable to both regulated and non-regulated fleets. The following section discusses one company's experience in implementing the standard in its non-regulated fleet. Baxter Healthcare has approximately 1,000 U.S. employees who drive regularly on business and are considered non-regulated fleet drivers. Most of these employees are part of the sales force. Baxter applies the Occupational Health and Safety Assessment Series (OHSAS) 18001 to assess and manage hazards that pose risk to employees. The Environment, Health and Safety (EHS) management system approach drives continuous performance improvement for Baxter.

In December 2008, the Baxter Corporate EHS audit team engaged an external fleet-safety expert and facilitated the first EHS-focused audit for its U.S. non-regulated fleet. The goal was to understand how Baxter managed its non-regulated fleet and more importantly, *fleet risk*. Managing fleet risk is important because it goes beyond the vehicle and incorporates effective management of drivers and driving behaviors. The audit revealed strong management of fleet operations, vehicle selection, and acquisition, with opportunities to improve upon a risk-based approach to manage fleet risk. Fleet safety audit components included interviews and an assessment of various areas including:

- The current process for managing fleet
- Identification of key stakeholders
- Types and number of vehicles
- Selection and acquisition of vehicles
- Vehicle use (e.g. carrying items, miles per year, type of driving...)
- Inspections, repair and maintenance
- Incident reporting and investigation
- Driver qualification
- Policies and procedures
- Performance evaluation (success metrics)
- Training and communication

Beginning early in 2009, a strong partnership was formed between Corporate EHS and the U.S. Fleet Manager. A strategy was developed and tactical plans defined an action timeline to close gaps identified during the fleet audit and to strengthen management of non-regulated fleet *risk*. Baxter's Fleet Manager led the effort and EHS leveraged a transitional leadership/ partnership style to provide guidance, expertise and support. The U.S. Fleet Manager engaged key stakeholders to support development and deployment of a tailored, Baxter approach.

Baxter referenced the voluntary consensus standard, ANSI/ASSE Z15.1-2006, *Safe Practices for Motor Vehicle Operations*, to support the development of a best-in-class approach to managing fleet risk. Because policies and

procedures are the foundation of a non-regulated fleet program, Baxter strengthened the overall driver policy. Further, Baxter developed and deployed a non-regulated fleet safety program and specific guidelines to cover aspects such as authorized driver requirements, safe vehicle use, and expected maintenance. Z15.1 provided the framework for Baxter's policy and guide, tailored to fit Baxter. Measurement systems were also enhanced, leveraging concepts from the standard. In 2009, Baxter was selected to participate on the ANSI/ASSE Z15 committee supporting the review and revision of the ANSI/ASSE Z15.1-2006 standard, *Safe Practices for Motor Vehicle Operations*, and supported revisions for the recently released ANSI/ASSE Z15.1-2012 revised standard.

ANSI/ASSE Z15.1-2012 and Commercial Fleets

When the ANSI/ASSE Z15.1 standard was first issued, it was hailed as a great document to help non-commercial fleets organize a safety effort to reduce costly motor vehicle crashes and reduce risk in motor vehicle operations. The following section of this paper will demonstrate the value of the standard for managing commercial fleets as well. In contrast to non-commercial fleets, commercial motor vehicle fleets are heavily regulated by Federal Motor Carrier Safety Administration (FMCSA) if they are interstate carriers and to a lesser degree by similar state agencies if they are intrastate carriers. It was theorized that commercial motor fleets were heavily regulated, and while parts of Z15 would certainly cover their operations, the FMCSA and its FMCSRs would ensure that commercial fleet operators had the required safety structure in place. Regulatory efforts notwithstanding, injuries and fatalities involving commercial motor vehicles continue to occur, and liability remains. Despite general declines in the number and rate of fatal crashes involving large trucks and buses in past decades, 573 occupants of these vehicles and 3,371 other road users died in large truck and bus crashes in 2010 (Federal Motor Carrier Safety Administration 2012 4). From 2009 to 2010, this represented a 9% increase in the number of large trucks and buses involved in fatal crashes, and a 9% increase in the rate of fatalities per 100 million miles driven (Federal Motor Carrier Safety Administration 2012 3).

Limitations of the FMCSRs

The FMCSRs contain detailed requirements for specific concerns such as hours of service (49 CFR Part 395), but have little to say about the basic policies and procedures that are the foundation of a workplace safety program. Overall, the FMCSRs are limited in scope and nonspecific. For example, the FMCSRs have very few requirements for written policies and procedures or documented annual training. The only required written procedures/policies in the FMCSRs are related to drug and alcohol testing (49 CFR Part 382) and a written security plan for hazardous materials (49 CFR Part 172.800). The FMCSRs have no requirements for a written crash/incident review policy, discipline procedure, driver hiring/orientation, and training in vehicle operation and inspection. There are some training requirements for drivers of longer combination vehicles, entry-level drivers, and HAZMAT drivers, including retraining for HAZMAT drivers every 3 years (49 CFR Parts 380 and 397). However, there are no requirements for annual defensive driving training, hours-of-service training, truck inspection training, or annual drug and alcohol training (although some initial training is required).

In the past, the FMCSA rarely had any interactions with commercial fleets, with the exception of Compliance Reviews (CRs). A CR was a full-blown audit that resulted in a rating of Satisfactory, Conditional, or Unsatisfactory. Fines could result, and an "Unsatisfactory" rating could cause the motor carrier to be shut down. The FMCSA also conducted Safety Reviews, normally after a significant event such as a fatality or too many serious crashes in a short period of time. Generally, however, few carriers interacted with the FMCSA; the number of drivers and carriers was far greater than the number of CRs performed each year (Federal Motor Carrier Safety Administration 2013).

ANSI/ASSE Z15 approach

ANSI/ASSE Z15.1 follows the same approach as Occupational Safety and Health Administration (OSHA) 29 CFR Parts 1910 and 1926 in that it is far more specific and broader in scope in its requirements for written policies/procedures and training than are the FMCSA regulations. It provides an all-inclusive framework for developing, implementing, and monitoring an organizational motor vehicle safety program. OSHA took a proactive and cooperative approach to work with employers to promote worker safety. OSHA also built more flexibility into their approach. They may visit a workplace to address a single issue. Although that issue may lead to a full audit, it is often the sole basis of OSHA's action. OSHA also has the authority and flexibility to forgo or reduce fines based on the individual company's response and actions to abate hazards identified. OSHA audits (those in which the company was fined as well as those in which the company agreed to certain actions to improve safety) seem to be very effective. They work!

The CSA model

The FMCSA introduced the Compliance, Safety, Accountability (CSA) program in late 2010 as a way to make

significant reductions in large truck crashes and make this segment of highway transportation safer (Exhibit 1). The program was to be introduced in several phases, with the last part, the Safety Fitness Determination, possibly coming by the end of 2013.

The first phase of the CSA model is Measurement (Exhibit 2). Under CSA, the FMCSA has made a number of changes in the way it reports violations by each motor carrier. Violations are now grouped into seven categories of similar violations, referred to as "BASICs," and assigned weights as to the probability of causing a crash. Since development of the original model (Exhibit 1), the FMCSA has made changes to the original BASICs: "Fatigue" is now "Hours of Service;" the "Cargo" BASIC is now a dedicated "Hazardous Materials" BASIC; and load securement violations are now in the "Maintenance" BASIC.

The final phase of the CSA model, Safety Fitness Determination, is vitally important to a carrier, as this

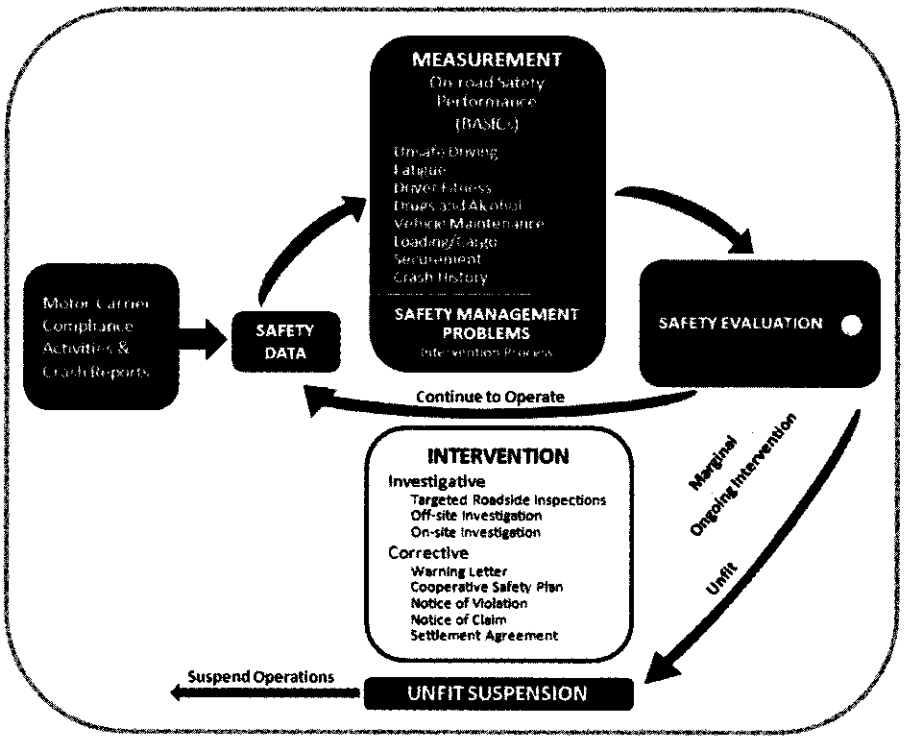

Exhibit 1. This shows the original CSA operational model put out by FMCSA in 2010. Source: http://csa.fmcsa.dot.gov/about/csa_how.aspx.

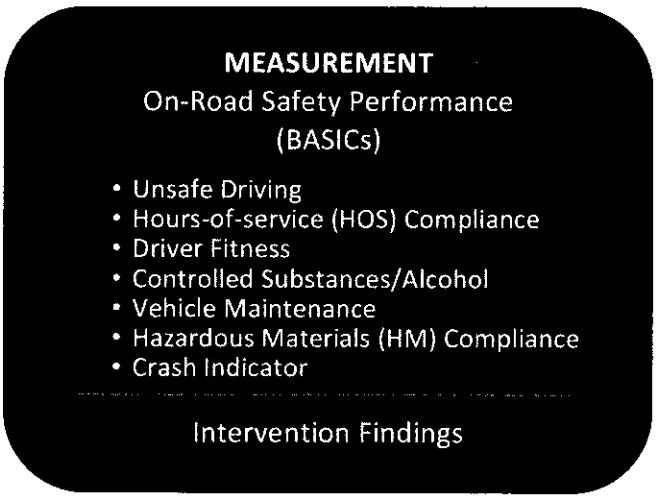

Exhibit 2. For reporting safety performance under CSA, FMCSA now groups violations into seven categories called BASICs.

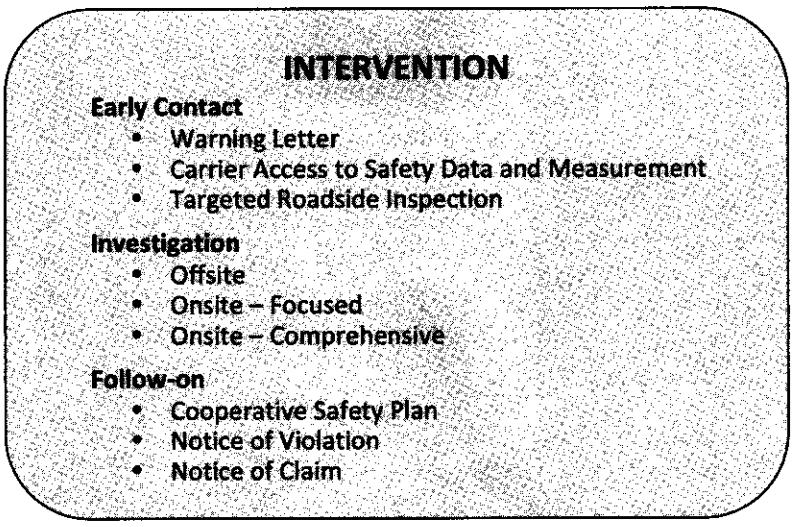

Exhibit 3. CSA interventions to improve safety performance are progressive in nature.

determination can mean whether they are able to continue to do business or must operate under a "marginal" designation. However, it is the middle phase, Intervention, which makes the ANSI/ASSE Z15.1 standard directly relevant to commercial fleets (Exhibit 3). The FMCSA envisioned a broader array of intervention tools that would be applied directly or in a progressive fashion to "motivate" fleets to be more proactive in their safety efforts.

FMCSA Safety Interventions under CSA

Under the new CSA model, the FMCSA looked for ways to increase interactions with carriers that were having "problems" as indicated by the new safety measurement system (SMS), but using methods that were less intensive than traditional CRs. One "early contact" intervention that has drawn a lot of attention from commercial fleet owners is warning letters, which are generated based on SMS scores. Nationwide's regular customer service outreach includes "DOT Compliance Class," which cover the FMCSRs for motor carriers. Although invitations were sent to a large number of carriers, only a small percentage of carriers attended, unless they had recently received a warning letter.

A second FMCSA intervention targets a company at the roadside, looking for specific violations as indicated by the SMS. This may include off-site and on-site reviews. For instance, if the SMS scores indicate that the company is having hours-of-service problems, FMCSA safety investigators may come to a carrier's main office, reviewing and scanning hours-of-service logs and taking action based on what they find. FMCSA investigators will likely look only at the hours-of-service records, focusing the visit on those violations and not examining other safety items such as maintenance records or driver qualification files. The advantage of this technique is that it allows the FMCSA to have contact with more carriers and to focus only on the areas in which the SMS indicated these carriers have issues. The rationale is that more contacts or higher chance of having a contact will result in carriers paying more attention to their SMS scores and that fearing fines, they will make improvements.

The Cooperative Safety Plan (CSP) is a new "Follow-on" intervention under CSA which to some extent addresses one of the shortcomings of FMCSA's approach: the lack of a model that allows it to work more cooperatively with carriers to reduce violations and improve performance. After intervening at a company, FMCSA may agree to withhold a Notice of Violations (NOV) if the company can devise ways to reduce the violations. While the term is Cooperative Safety Plan, essentially the company is charged with developing effective solutions to the areas in which they have problems. The FMCSA will either agree or disagree as to whether the actions are a good faith effort and will then monitor the company for progress. This is where the gap in the FMCSRs with regard to written policies and procedures is evident, and this is where ANSI/ASSE Z15.1-2012 comes into play.

It is difficult to envision how FMCSA can be assured that the carrier will follow the CSP in the absence of the policies and procedures needed for implementation and the documented training to show commitment and improvement. The answer is simple. Participating in a CSP to ward off a Notice of Violation (NOV) requires a written plan submitted to FMCSA, and such a plan will clearly need to be supported by a policies and procedures manual. Using Z15 as a guide will make this easy.

The Safety Management Cycle

The FMCSA has put forth the Safety Management Cycle (SMC) as a guide to help motor carriers develop the required CSP documents. The SMC starts with the concept that policies and procedures are needed to move forward. The SMC has six elements that are referred to as safety management processes (SMPs) (Exhibit 4). The FMCSA has prepared a document for each of the seven BASICs, which will help companies develop policies and procedures for that BASIC in accordance with the SMC (http://csa.fmcsa.dot.gov/about/smc_overview.aspx).

Safety Management Processes

The six SMPs are the backbone of the SMC. As demonstrated below, the ANSI/ASSE Z15.1-2012 standard matches up well with the SMC and the safety management processes (SMPs) that were recently introduced by the FMCSA:

1. **Policies and Procedures** define the "what" and "how" of a motor carrier's operations. Policies establish the guidelines for how motor carriers and their employees behave in a given situation. Procedures explain how to accomplish policies. The other five SMPs focus on how to implement the policies and procedures. It is important to understand that the FMCSA is basing agreements on improvements on a sound foundational policies and procedures manual, one that covers the areas it sees as having a great impact on safety. Many companies don't have a well-thought-out written policies and procedures manual. ANSI/ASSE Z15.1-2012 provides that foundation.
2. **Roles and Responsibilities** clearly define what each employee should do to successfully implement the policies and procedures. A good policy manual discusses roles and responsibilities at each level of the employee/employer relationship. ANSI/ASSE Z15.1-2012, Section 3.2.1.3, requires that a system of accountability and responsibility be established. It advises implementation of this system through several of an organization's units, including operations, human resources, and safety.
3. **Qualification and Hiring** discusses recruiting and screening applicants to fulfill the roles and responsibilities for positions. ANSI/ASSE Z15.1-2012, Section 3.2.1.3, covers driver recruitment, selection and assessment, and Section 5.1 covers the development of driver qualifications, job descriptions, applications, and background checks. Companies should have a defined policy that lists minimum qualifications or disqualifying events – these should be concrete requirements that don't fluctuate with the job market – and

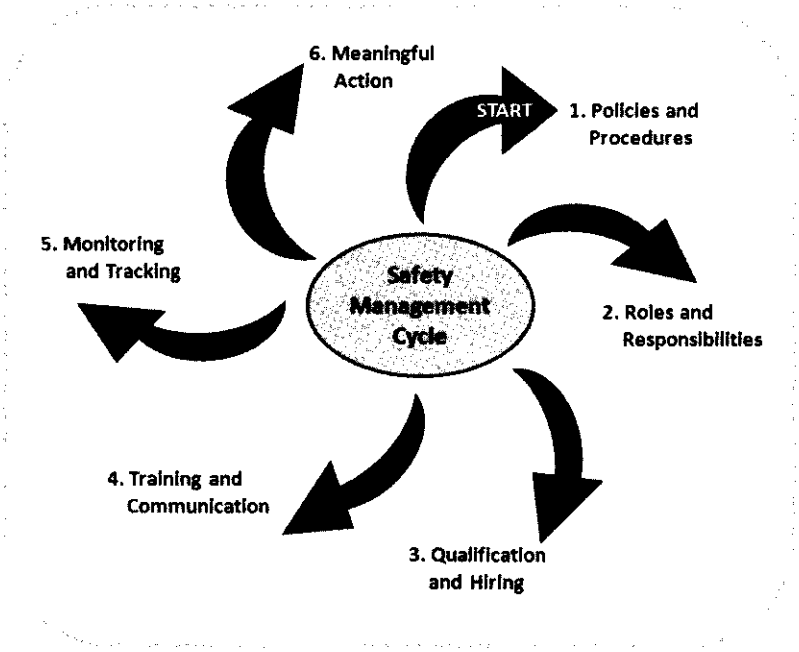

Exhibit 4. The FMCSA has recommended the Safety Management Cycle (SMC) as a guide to implementing CSA and preparing CSPs.
Source: http://csa.fmcsa.dot.gov/about/smc_overview.aspx

systems in place to conduct adequate background checks as required by statute. They should also consider other processes that are not required, such as pre-employment screening, bonding, and criminal checks.

4. **Training and Communication** outlines a motor carrier's communication of its policies, procedures, roles, and responsibilities so that everyone understands the expectations and has the adequate skills and knowledge to perform their assigned function. ANSI/ASSE Z15.1-2012, Section 3.2.1.5 covers orientation and training, and Section 5.3 covers driver training. Ideas from both these sections need to be incorporated into a procedure that tracks how orientation and training goals are achieved. Section 3.2.1.7 highlights the need for communication.
5. **Monitoring and Tracking** concentrates on the need to have a system in place to monitor and track employee performance, enabling a company to be aware of employees' safety performance and compliance with its policies and procedures and how they execute their roles and responsibilities. "Monitoring" represents the motor carrier looking at the performance of the operation, and "Tracking" is assessing the data collected, leading to meaningful action. ANSI/ASSE Z15.1-2012, Section 3.2.1.11 requires a system of management audits to ensure that requirements within a policy/procedure are in fact carried out.
6. **Meaningful Action** gives motor carriers the tools to correct or improve employee behavior, including training and positive reinforcement such as rewards or bonuses, in order to improve the motor carrier's overall safety performance. Sections 7.2.3, 7.2.4, and 7.2.5 all talk about corrective action and incident review, which are meant to spur meaningful action.

Merging ANSI/ASSE Z15.1-2012 with the material provided by the FMCSA results in a very thorough policies and procedures manual. Appendix 2 recommends additional elements to be included in the manual.

A Systems Approach to Z15.1 Implementation

The safe-system approach to road safety

The last two decades have brought a gradual shift in thinking about how road safety improvements can best be achieved. This shift is marked by a new view of the road as a system, and a shift in responsibility for road safety away from the individual road user to designers of the road infrastructure and designers of vehicles (Organization for Economic Cooperation and Development 107-112). The ANSI/ASSE Z15.1 standard is consistent with the safe-system approach in several ways:

- It assumes that the organization is responsible for developing programs, policies, and procedures for managing road risk associated with any motor vehicle operated on behalf of the organization.
- It addresses management of risks related to the driver, vehicle, and operating environment.
- It advocates continuous measurement and review to document successes and identify areas for improvement.

This section provides background information on several safe-system initiatives and explains how ANSI/ASSE Z15.1 is congruent with them.

Vision Zero and the safe system

The safe-system approach to road safety management originated with the "Vision Zero" model developed in the Swedish Road Administration in the mid-1990s. Although road users are still expected to follow the rules of the road, Vision Zero makes designers responsible for continuous modifications to the road system as situations in which human error leads to crash-related injuries are identified (Johansson 827). The goal for traditional road safety approaches was to prevent crashes, while the Vision Zero goal is to eliminate death and serious injury. Vision Zero accepts the idea that road users will inevitably make errors, but its aim is to engineer the road environment and the vehicle to be so forgiving of human error that deaths and serious injuries will be eliminated.

Although Vision Zero was formulated as a framework for managing the entire transport system, it also applies to management of road safety within companies and organizations. In the same way that it sees the road environment as a system that should be forgiving of human error, Vision Zero also calls for a management system at the organizational level that is responsible for modifying the conditions of work to reduce, if not eliminate, the potential for road traffic injury. A primary contribution of Vision Zero to occupational road safety is its support for shifting responsibility away from the individual driver toward the company or organization that employs the driver.

Road safety initiatives similar to Vision Zero have been adopted in other countries, most prominently in the Netherlands through its "Sustainable Safety" strategy and in Australia through its "Safe System" model (Organization for Economic Cooperation and Development 108). In 2009, the United States began to move in a similar direction with the launch of "Toward Zero Deaths,"

for the first time pursuing a strategy that conceptualized any injury or death on the road as unacceptable (http://safety.fhwa.dot.gov/tzd/).

The ISO 39001 standard

Another outgrowth of the safe-system approach to road safety is a new global standard for road safety management, ISO 39001:2012, *Road Traffic Safety (RTS) Management Systems – Requirements with Guidance for Use.* Because the Swedish Standards Institute serves as the secretariat for ISO 39001, this consensus standard was strongly influenced by Vision Zero. ISO 39001 was designed for use by any public or private organization that wishes to improve its road safety performance, develop and implement a road safety management system, and check its progress toward road safety targets. It is relevant for organizations that transport goods or people, or whose employees or contractors interact with the road system in any way in the course of doing business. Like the ANSI/ASSE Z15.1 standard, ISO 39001's requirements are placed within a framework of roads, vehicles, and users. The main body of ISO 39001 is supplemented by non-mandatory appendices that provide guidance for implementation (International Organization for Standardization).

ANSI/ASSE Z15.1 as a systems approach

All the initiatives described here have common features that are especially relevant to the management of vehicles by companies and organizations – features that they share with the ANSI/ASSE Z15.1 standard:

- They value comprehensive management and communications structures that incorporate all the stakeholders for road safety, including private-and public-sector organizations that are key users of the road system.
- They see road safety as a responsibility shared among all these stakeholders.
- They value continuous data collection and feedback, including cost and economic analysis, as critical to ensuring that investments in road safety are effective and provide a favorable return on investment (Organization for Economic Cooperation and Development 108).

Using ANSI/ASSE Z15.1 to develop and implement a motor vehicle safety program

ANSI/ASSE Z15.1 assumes that management commitment and leadership are the foundation of any organization's road safety management program. It uses a central framework of drivers, vehicles, and operating environment to organize policy areas that should be managed by organizations, and it mandates a process of continuous review and improvement based on in-depth review and response to individual incidents combined with analysis of aggregated data (ANSI/ASSE 2006, 2012). Organizations can use the basic structure of ANSI Z15.1 at several points during development and implementation of a road safety management program: to identify gaps in an existing program, to ensure that policies and procedures are adequately addressing the gaps identified, and to develop key performance indicators (KPIs) that will be used to set program goals and track progress.

Identifying program gaps and implementing interventions

The Haddon Matrix is a tool that can be used in conjunction with the ANSI/ASSE Z15.1 standard to help identify program gaps. It was developed by American epidemiologist William Haddon, Jr., who was a prominent advocate for crash prevention and injury control and the first Administrator of the National Highway Traffic Safety Administration. Haddon conceptualized injury prevention as a problem of reducing or eliminating the exchange of harmful mechanical energy (Haddon, Jr. 1968 1433). The simplest version of the Matrix is a 3 × 3 table (Table 1). The rows denote "phases:" points in time a hazard is present or an intervention can be put in place. The columns denote "factors:" sources of risk or points of intervention to control the risk (Haddon, Jr. 1972 96-97).

The use of the Haddon Matrix is not limited to road safety for the general population. The Matrix can be expanded to fit the needs of any organization that operates motor vehicles, and this expansion can aid in implementing the ANSI/ASSE Z15.1 standard. Haddon himself showed how the "Human" cell could be separated into road user types such as drivers, pedestrians, and motorcyclists, allowing a more refined assessment of risks and interventions (Haddon, Jr. 1968 1436).

For organizational users, research and policy documents have recommended the addition of columns to

TABLE 1

The basic Haddon Matrix combines temporal 'phases' with 'factors' where crash risks and injury prevention opportunities are present

	Human	Vehicle/ Equipment	Environment
Pre-crash			
Crash			
Post-crash			

cover factors related to management and journeys (see, for example, European Transport Safety Council 4-5).[4] Addition of information on management reinforces the ANSI/ASSE Z15.1 standard, where discussion of the importance of leadership, management commitment, and a strong administrative structure precedes any discussion of policies for the driver, vehicle, and operating environment. Published case studies of successful fleet safety programs underscore the importance of having a steering committee charged with implementation and oversight. Not only does this promote broad buy-in across organizational units, but it guards against the danger of entrusting the program to a single key individual whose departure could threaten the program's future (Murray et al. 6-7).

For identifying program gaps, the Haddon Matrix helps an organization to ask the questions: "Which of these risks are we addressing?" and "Where are policies and procedures needed?" For identifying and implementing interventions, the Matrix helps an organization to ask: "What interventions can we put in place to reduce or eliminate these risks?" Table 2 below shows how the Haddon Matrix might be adapted to an initial assessment of program gaps or a check for compliance with ANSI/ASSE Z15.1 elements.

A number of prominent policy documents have cited the Haddon Matrix as a valuable tool for identifying problems and prioritizing interventions. Chief among these is the influential *World Report on Road Traffic Injury Prevention* (Peden et al. 12-13). In addition, the plan of action developed for the UN Decade of Action for Road Safety 2010-2020 is based on five "pillars:" road safety management, safer vehicles, safer roads and mobility, safer road users, and post-crash response (World Health Organization and UN Road Safety Collaboration 11). The pillars for the Decade of Action closely mirror both the Haddon Matrix and sections 3 through 6 of the ANSI/ASSE Z15.1 standard. Finally, and most important, fleet and safety managers, fleet service providers, and researchers have reported successfully using the Haddon Matrix for assessment of program gaps, as discussed above and shown in Table 2 (Darby et al. 437, Murray et al. 4, Wallington et al. 4-5).

Using ANSI/ASSE Z15.1 to develop metrics and track progress

The main portion of the ANSI/ASSE Z15.1 standard requires organizations to follow a process of reporting, reviewing, analyzing, and corrective actions in response to individual motor vehicle incidents and collisions. It also requires organizations to take a broader view by collecting data needed to track road safety performance over time. Early in its deliberations, the ANSI Z15 Committee determined that the standard should not mandate that all organizations use the same outcome measures or the same reporting intervals. Instead, ANSI/ASSE Z15.1 provides appendices with more specific but non-mandatory guidance in these areas, allowing organizations the discretion to select what is most appropriate. The current version of the standard, ANSI/ASSE Z15.1-2012, offers the following:

- Appendix F recommends specific points to be included in instructions for the driver's on-scene response in the event of a collision.
- Appendix G recommends factors to be considered during reviews of incidents and collisions. The list of factors is organized according to those related to the driver, the vehicle, and the environment.
- Appendix H provides several basic measures that may be used to track motor vehicle incidents. (ANSI/ASSE 2012 33-38).

Rate calculation examples from ANSI/ASSE Z15.1

For the rates suggested by ANSI/ASSE Z15.1 -2012, the numerator is generally either the number of incidents or the number of incidents resulting in injury. The denominator for a rate is the exposure unit of interest. Key denominator data for tracking fleet safety performance are the number of vehicles and number of vehicle miles traveled (VMT). Depending on its operating environment, an organization may also choose to report rates based on units of service such as the number of deliveries or loads. Selected rates included in Appendix H of the standard are discussed below (ANSI/ASSE 2012 37-38).

An incident rate based on the number of vehicles is essentially the proportion of the vehicle fleet involved in an incident over some pre-determined period of time. It can help an organization assess the proportion of the fleet that may be out of service at any given time, and can also inform decisions about vehicle replacement.

- Incident rate based on number of vehicles operated:

$$\frac{\text{Number of incidents} \times 100}{\text{Number of vehicles}}$$

VMT-based rates are important measures because they are based on exposure to road traffic hazards. They may also be adapted to compare the rate of incidents for

[4] The Haddon Matrix has also been suggested as a way to identify gaps and interventions related to an organization's engagement with external partners and its "corporate social responsibility" agenda for road safety (European Transport Safety Council 4-5). This is largely outside the scope of the ANSI/ASSE Z15.1 standard

TABLE 2

The Haddon Matrix is easily expanded and adapted to check for compliance with provisions of the ANSI/ASSE Z15.1 standard. Relevant portions of the standard are referenced in parentheses

Original elements of Haddon Matrix			Additional elements for occupational road safety	
Human	**Vehicle**	**Environment**	**Management**	**Journey**
Pre-crash				
Formal criteria for: • Driver qualification and selection (3.2.1.3, 5.1.1, 5.1.2) • Motor vehicle record checks (5.1.3) • Driver orientation and training (3.2.1.5, 5.3) Driver management program (5.2)	Formal criteria for: • Vehicle selection and specification (3.2.1.8, 6.1) • Vehicle modifications (6.2) • Regular servicing and maintenance (3.2.1.9, 6.6) • Pre-trip vehicle checks (6.5) • Vehicle replacement (6.7) Policy for business and personal use of organizational vehicles (4.7.1, 4.7.2, Appendix A, B Policy for business use of personal vehicles (4.7.3, Appendix C)	Formal policy on: • Use of occupant restraints (4.1) • Impaired driving (4.2) • Distracted driving (4.3, Appendix E) • Aggressive driving (4.4) System to monitor regulatory compliance (3.2.1.10, 3.2.1.11)	Interest, involvement and commitment to road safety from senior management (3.1) Allocation of adequate staffing and resources to manage and support the program (3.1) Written safety program defining organizational requirements (3.2) Accountability and responsibility throughout the organization (3.2.1.2) Auditing process (3.2.1.11) Procedures to document driver qualification and training (5.4) Procedures to report, record, and investigate incidents, and to track safety performance over time (7.3; Appendix F, G, H) Reporting of major incidents and overall road safety performance to all levels of management (3.2.1.6)	Risk assessment covering: • Need to travel for specific purposes • Modal choice • Journey planning and route selection • Inclement weather • Journey scheduling • Shifts/working time • Means of communicating information about weather emergencies, road construction (4.5, 4,6) Travel policy to cover decision processes for: • Fatigue management • Changes in travel plans due to inclement weather or emergency (4.5, 4.6)
Crash				
Instructions for drivers in the event of a crash (7.1.1, Appendix F, A)	Emergency equipment/ kit for use in the event of a crash (6.3)	Policies for managing crash scene (Appendix F)	Policies for interactions with law enforcement and third parties at the scene (Appendix A)	
Post-crash				
Driver reporting of incident/crash to organization (7.1.2, Appendix A, F) Corrective action directed at driver, if appropriate, to improve skills and behaviors (7.2.4, 7.2.5)	Review of vehicle-related factors and circumstances (7.2, Appendix G) Corrective action related to vehicle policies, if appropriate (7.2.5)	Review of factors and circumstances related to operating environment (7.2, Appendix G) Corrective action related to policies for the operating environment, if appropriate (7.2.5)	Process to report and record incidents (7.1, 7.1.1) Process to review incidents and identify causal and contributing factors (7.2, 7.2.1, Appendix F, G) Incident review report (7.2.3) Corrective action communicated throughout organization, if appropriate (7.2.5)	Review of factors and circumstances related to journey management (7.2, Appendix G) Corrective action related to journey management policies, if appropriate (7.2.5)

different types or models of vehicles in the fleet, or under different operating conditions.

- Incident rate based on vehicle mileage:

$$\frac{\text{Number of incidents} \times 1{,}000{,}000}{\text{Vehicle miles traveled}}$$

The calculation of the rate of injury incidence is another good example of the flexibility the ANSI/ASSE Z15.1 standard affords an organization. Here, the numerator may be adjusted in a number of ways. At the outset, it is important that an organization-wide definition of an injury be established. ANSI/ASSE Z15.1-2012 defines an injury as "Physical harm or damage to a person resulting in the marring of appearance, personal discomfort and/or bodily harm, impairment or death" (ANSI/ASSE 2012 11). By design, this definition does not dictate specific criteria for an injury; an organization may choose its own threshold. Commonly used thresholds for classifying a case as an injury are the requirement for any

kind of medical treatment, restricted work activity, or 4 or more hours of lost work time.

Once a clear definition of an injury is established, if the goal is to supplement data on lost productivity or workers' compensation costs, the numerator might appropriately be the number of injury incidents for workers in the organization only. If the goal is to assess the number of incidents with potential liability for the organization, the number might be the number of incidents involving injury to a third party. If the goal is to assess overall exposure for the organization, the two numbers might be combined.

- Injury incident rate:

$$\frac{\text{Number of incidents with injury} \times 1{,}000{,}000}{\text{Vehicle miles traveled}}$$

Developing and using key performance indicators

Basic rates shown in Appendix H of ANSI/ASSE Z15.1 are useful for summarizing road safety performance within an organization and tracking progress over time. The standard can also help organizations set targets and track progress toward specific program goals and objectives. Again, elements of the standard, organized within the Haddon Matrix, help an organization to select the most appropriate key performance indicators (KPIs) for its needs, and to check to ensure that data are being collected to make it possible to calculate these KPIs.

When considering data collection requirements related to management of a motor vehicle safety program, it is important not to lose sight of which data elements are essential and which are merely "nice to know." Data collection requirements should be linked to specific reporting requirements: those that are needed to calculate basic rates described above, and those that contribute to calculation of KPIs.[5] Data elements are generally a combination of "process" and "outcome" measures. Outcomes are important because they are the end points a program wants to achieve, for example, a certain level in reduction in crashes per million miles. The recommended rates provided in Appendix H of the ANSI/ASSE Z15.1 standard are outcome measures.

Processes are also important, however, because they represent milestones along the way to achieving those outcomes, and they can pinpoint places in the management system where adjustments are needed to continue progress toward the desired outcome (Poister 106-111). A process indicator relevant to the ANSI/ASSE Z15.1 standard might be the percentage of workers completing behind-the-wheel training within 6 months of hire.

TABLE 3

A KPI should be supported by other data that will help identify opportunities to accelerate progress toward the organization's target for that KPI

Sample KPI: % of 'preventable' incidents in which organization's driver was distracted
Relevant data elements:
• Total number of incidents (based on organization's pre-determined criteria for defining an incident)
• Number of distracted-driving incidents (based on incident review procedures, and including external sources of information such as police reports and cell-phone records, if applicable)
• Number of 'preventable' incidents (based on incident review procedures)
'Process' measures to support this KPI:
• Does organization have a cell-phone policy or a more general distracted-driving policy?
• What percentage of the organization's drivers has signed an acknowledgment of this policy?
• How well do supervisors reinforce importance of the policy?
• Are other organizational practices and policies consistent with workers abiding by this policy? For example, do scheduling practices allow time for organizational business to be completed without incentivizing use of electronic devices or eating meals while driving?
• Are there results from employee surveys on safety climate or safety attitudes that suggest how communications strategies can be adjusted to increase compliance?

The Haddon Matrix example provided in Table 2 can be a starting point for developing process and outcome KPIs for specific program areas. Table 3 shows how an organization might think through what is needed to support a KPI related to distracted-driving crashes. Some of the more process-related measures are quantitative, while others will be based on more qualitative assessments and knowledge of the organization. Here, it is important to note the distinction between a KPI and a target value for that KPI. The KPI is the measure, but the organization should also determine the value it wants to achieve for that KPI.

Summary and Conclusion

The ANSI/ASSE Z15.1 standard, *Safe Practices for Motor Vehicle Operations*, provides minimum requirements for workplace motor vehicle safety programs. Although the standard was initially conceived as filling a gap by providing guidance for non-DOT-regulated fleets, Z15 is, in fact, applicable to any size fleet and any type of organization that operates motor vehicles. It complements the FMCSRs and FMCSA's new CSA initiative by providing a critical framework for development of a safety management system and policies and procedures – a framework not found in the FMCSRs.

[5] There are of course many other reporting requirements related to financial, human resources, and regulatory compliance. These are outside the scope of this discussion.

Because it specifies policies and procedures related to the driver, vehicle, and operating environment, all of these in the context of a safety management system, Z15 is also consistent with other well-established injury prevention models, including those that follow a "systems" approach. Combined with the Haddon Matrix, Z15 can be a starting point for a comprehensive risk assessment for any type of vehicle fleet, leading to development of appropriate interventions.

For more information about ANSI/ASSE Z15.1-2012

For more information, or to purchase a copy, please consult the following resources:

- ASSE Tech Brief on the revised standard, ANSI/ASSE Z15.1-2012: http://www.asse.org/publications/standards/z15/docs/Z15_1_Tech_Brief_4_2012.pdf
- Trifold brochure on the revised standard: https://www.asse.org/ShopOnline/products/docs/ANSI%20Brochure%20Z15%20Std_%20Fi nal.pdf
- Ordering page: https://www.asse.org/shoponline/products/Z15_1_2012.php

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

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Appendix 2

Recommended Outline for Policy and Procedure Manuals

Safety Policy/Statement

- Safety mission statement that is conveyed on a constant basis

Responsibility and accountabilities

- Policy setting forth who is responsible for what. **Very Important.**
  - *Assignment of safety functions*
  - *Assignment of auditing requirements*
  - *Chain of command on safety issues*

Driver Recruitment

- Assessment
  - *Job description, with safety expectations*
  - *Road test*
  - *Written test (not required)*
  - *Background check*
    - *Work history documentation*
    - *Drug and alcohol checks*
    - *Criminal history, if required*
- Selection guidelines
  - *Experience required*
  - *Medical examination*
  - *Motor vehicle record (MVR): what is acceptable*
  - *PSP: Pre-employment safety screening program report/ roadside history*
  - *If owner/operator, a review of their DOT number*

Orientation and Training

- New employee training and orientation
  - *New driver checklist*
  - *Driver qualification files*
    - *Biennial review of file*
    - *Annual checks of MVR*
    - *Review of driver qualifications*
      - *Hazmat*
      - *Entry level*
      - *Longer combination vehicles*
      - *Tanker Driver Trainer*
      - *New driver ride-alongs*
      - *Training on your equipment and configurations*
    - *Drugs and alcohol*
      - *Decision on allowing return to work*
      - *Retention and storage of records*
      - *Procedure for immediate removal*
- Employee retraining
  - *Post-crash*
  - *Post-incident*
- Recurrent training
  - *Hazmat*
  - *OSHA safety training*
- Specialized training
  - *Tanker*
  - *Load securement*
  - *Longer combination vehicles*

Organizational Procedures and Rules

- *General Discipline Procedure* that can be applied to safety and operational violations
- *General Safety Policies*
  - Required by regulations
    - *Drug and alcohol testing procedures/policies (if you employ drivers with a Commercial Driver's License (CDL)*
    - *Security Plan (if you haul hazardous materials)*
  - Company directed
    - *Passengers*
    - *Personal use*
  - Compliance with all traffic and motor carrier regulations and laws – General in nature
- *Crash Countermeasures/ Driving practices*
  - Distracted driving
  - Weather/dispatch policy
    - *General*
    - *Procedures to hold dispatchers accountable for dispatching drivers in runs that cannot be made legally*
  - Speed policy
  - Following distance policy
  - Right lane/ lane change policy
  - Safety belts
  - Hours of Service (HOS)
    - *Adherence to the regulation*
    - *Log retention and submission*
    - *Procedure on how HOS are audited*

Incident and Crash Review

- Evidence retention
- "Black box" retention policies
- Files and photos
- Purpose of incident and crash reviews:
  - *Preventability determination?*
  - *Development of procedures/ training to prevent future accidents?*

Rewards and Recognition

- Does the company have a system to reward and recognize achievements of drivers?

Vehicle Specification and Selection

- A policy that details the development of specifications for vehicles and trailers to be used in the operation. This policy should help determine which equipment is proper for the safe operation rather than external factors such as cost, availability or driver wants.

Inspection and Maintenance

- Does the company have a policy describing the system to:
  - Maintain records
  - Maintain system of preventative inspections
  - Roadside inspections reported
  - Driver vehicle inspection report (DVIR)
- If company uses owner/operators (O/O), policy to review O/O equipment prior to allowing use? Policy on repairs of O/O equipment?

Management Program Audits

- Is there a procedure specifying audit functions that management does to insure requirements are being met at all levels? Are they reported back to top management?

Chapter 8

Benchmarking and Performance Criteria

Edward Musal

LEARNING OBJECTIVES

- Be able to develop and administer a fleet accident/incident reporting system.
- Be able to develop and administer a fleet accident/incident record-keeping system.
- Understand the benchmark selection process.
- Be able to perform statistical analysis of fleet accident/incident data, including the ability to calculate incidence rates and to prepare a control chart.
- Understand the importance of accident statistical reporting.
- Understand the uses and limitations of incentive programs.
- Understand the legal implications associated with accident records.

Benchmarking and performance appraisal are as important to fleet safety as they are to any other safety program; indeed, they are important in any management activity. Using benchmarking and performance appraisal will provide a "report card" that can be used to measure the effectiveness of any safety program. The statistical information that supports this activity can also be useful in identifying weaknesses in a safety program so that resources can be allocated for maximum effectiveness. In addition, the incident-reporting and record-keeping framework may be useful in evaluating the effect of proposed activities related to fleet safety.

One must be careful in choosing benchmarks in fleet safety. Choosing them is often quite difficult (see discussion in Benchmarking section). While *Injury Facts*, put out by the National Safety Council (NSC), provides a wealth of statistics for all areas of safety, including fleet safety, safety professionals must consider the unique characteristics of their fleets when choosing a benchmark. Important considerations include the size of the fleet, the type(s) of vehicles that comprise the fleet, and the area in which the fleet operates (road conditions, traffic conditions, weather, and so on).

Much of the information presented in this chapter is based on the author's experience. Where there is no citation in the text to support a specific item, the item is based on the author's experience. At this point it is appropriate for the author to summarize his experience in fleet benchmarking and performance appraisal so the reader may understand the background of the viewpoints presented. He was employed by the New York City Transit Authority, currently Metropolitan Transportation Authority-New York City Transit (NYCT), for 23 years (1973–1996). During most of this time his main function was related to all aspects of accident record keeping, including employee, motor vehicle, and passenger accidents record keeping. His responsibility began with classification. At the end of his career with NYCT, he managed a work unit of five professional employees whose sole responsibility was accident record keeping, analysis, and report preparation. During this period, accident record keeping and analysis at NYCT evolved from a manual system with minimal

analysis to a complex computer-based system using sophisticated statistical techniques.

During the author's tenure at NYCT, the Manhattan and Bronx Surface Transit Operating Authority (MaBSTOA), which operates most of the bus service in the Bronx and Manhattan, was integrated into NYCT, which operates most of the bus service in the other three boroughs of New York City. In addition to buses, NYCT operates a fleet of maintenance vehicles for both rapid transit and bus operations as well as supervisory patrol cars. At the time of his employment, NYCT also maintained its own police force. This transit police force was subsequently absorbed into the New York City Police Department. The fleet accident record-keeping system managed by the author included vehicles supporting all of these operations. All the examples presented in this chapter are drawn from his experiences with NYCT.

Sources

A list of references is provided at the end of this chapter. As an introduction, however, it is appropriate to identify the four most pertinent sources in the United States. Two American National Standards Institute (ANSI) standards relate to fleet benchmarking and performance appraisal:

- ANSI Z15.1 *Safe Practices for Motor Vehicle Operations* (2006) §6.0 ff presents requirements for incident reporting, record keeping, and analysis.
- ANSI D16.1 *Manual on Classification of Motor Vehicle Traffic Accidents* (1996) provides a classification system that may be used in accident record keeping and analysis.

As indicated earlier, the National Safety Council's *Injury Facts* (previously *Accident Facts*) provides a wealth of accident statistics, including fleet accident statistics, for possible use in benchmarking. The Network of Employers for Traffic Safety (NETS) also provides benchmarking information (www.trafficsafety.org).

In addition to these general sources, there are quite a few industry-specific sources. Some types of motor vehicle fleets are required to report accident statistics to a governmental agency. Statistics on public transit accidents are available from the Federal Transit Administration of the Department of Transportation (DOT). The Bureau of Transportation of the DOT also maintains accident statistics.

Various trade groups catering to specific industry segments also have potentially useful information. These include the American Trucking Association, the American Public Transit Association, the School Bus Information Council, the United Motorcoach Association (which performed a benchmarking study in 2001), and the American Bus Association (which has a 2000 census of the motorcoach industry). A Web site dedicated to fleet safety benchmarking has been set up in the United Kingdom at www.fleetsafetybenchmarking.net. In addition, an Internet search for a specific type of fleet could be rewarding.

Accident Reporting

The foundation on which a fleet's benchmarking and performance appraisal system is built is its accident-reporting system. If this system is not properly designed and implemented, benchmarking and performance appraisal are valueless. People in the computer programming business have an acronym that precisely describes this: GIGO—garbage in, garbage out. It is absolutely necessary to precisely define the criteria for a recordable incident. It is also necessary to implement controls to be sure that all recordable incidents will be captured in the system. These issues will be dealt with in more detail later in this section. The first focus is on the methodology of accident reporting.

There are several means by which fleet management may obtain information about an incident. The usual first report is from the driver of the fleet vehicle involved in the accident. However, the driver may not be aware of an accident or may choose to avoid reporting it (especially if there is minor or no damage to the fleet vehicle), hoping it will be overlooked. Depending on the seriousness of the accident and the fleet's policy, a supervisor may be dispatched to the scene to perform a detailed investigation. It is also possible that a field supervisor may witness the accident. The driver of the other vehicle (if there is one) may be interviewed as part of the supervisor's investigation or may independently contact fleet management. A bystander (or passenger on the fleet vehicle) may be interviewed or may independently contact fleet management. Depending on fleet procedures, the first report of an accident may come after the driver turns in the vehicle from maintenance personnel (or another operator) who inspects the vehicle and notes damage not previously present. Finally, the first notice of an accident might be a lawsuit filed by an aggrieved party. This could occur many months after the alleged incident. The accident-reporting system should provide for all of these potential sources of information. Recent developments in computer technology have allowed several fleets to develop methods of allowing incidents to be reported by computer over the Internet. This provides more timely and accurate accident information as data transcription is eliminated. Several such systems can be found through an Internet search.

If a fleet is large enough to have more than one vehicle dispatch location, such as a nationwide trucking company, its accident-reporting system may be centralized or decentralized. If there is more than one dispatch location, should each location have a person or unit responsible for collecting information about incidents and providing the information to a single fleet location (decentralized), or should the entire fleet have a single unit (centralized) responsible for collecting incident information and providing information to the appropriate dispatch locations? There are certain advantages to each of these methodologies.

The *decentralized* method has the advantage of being closer to the incident. Accordingly, more detailed information can be acquired more quickly, so the initial report of the accident is likely to be more complete and accurate than if a centralized system were used. The major advantage of the *centralized* system is that fewer people collect information and prepare initial accident reports, providing a greater degree of consistency. The centralized system also provides an easier way of incorporating accidents first reported to fleet management (calls to the main office and lawsuits filed) than the decentralized system. Another advantage of the centralized system is that it takes the system out of the control of local management, which may unfairly benefit from not having some accidents reported.

Especially with larger properties, accident reporting may overlap with other reporting systems. If a fleet employee is injured in the accident, the accident may be reported through the employee accident-reporting system, the Workers' Compensation system, and/or the medical reporting system (if the employee sees a physician and the fleet pays for the visit or has its own physician). If a lawsuit is filed with regard to the accident, the accident may be entered into a system used to track lawsuits. It is prudent for people responsible for accident reporting to establish a liaison with people responsible for other reporting systems to see that all systems receive the proper incident reports.

To avoid duplication of effort within an organization, it may be appropriate to expand the accident-reporting system to include nonaccident events of interest to management. As mentioned earlier, the usual sources of accident-reporting information are fleet vehicle drivers, who are also the usual source of information about other incidents related to vehicles and their operation, such as

- criminal activity involving a fleet vehicle (robbery, hijacking, and so on)
- accidents not involving fleet vehicles that are witnessed by fleet drivers
- injuries to a driver or passenger due to nonvehicular accidents
- illnesses of a driver or passenger
- vehicle breakdowns
- other miscellaneous incidents

CASE STUDY 1

Overview of a Sample Accident-Reporting System

This case study presents the NYCT's fleet accident-reporting system for its bus operation and is based on an unpublished master's thesis by the author (1994).

The first verbal report of the incident is directed to the accident desk located within the fleet's centralized communications center, which is manned 24 hours a day, 365 days a year. The report is usually transmitted by radio immediately after the incident by the driver of the fleet vehicle. Occasionally the first report to the accident desk may come from another fleet employee, such as a maintenance employee discovering vehicle damage, a public affairs person taking a complaint from the public, or an attorney receiving notification of a lawsuit. The person at the accident desk enters the information constituting the initial incident report into a structured database (the specific data elements will be discussed later in the Accident Record Keeping section). If appropriate, the accident desk notifies the vehicle dispatch location to send a supervisor to the incident scene to conduct an investigation. More serious incidents (multiple injuries/fatalities) are reported to the fleet safety unit for more thorough investigation.

After completion, the written initial report (referred to as a *brief* because it contains only basic information; see Figure 1 for a sample brief and Figure 2 for an explanation of the information that is included) and a short description of the incident (a few sentences) are immediately transmitted electronically to the dispatch location (both operations and maintenance) responsible for the fleet vehicle involved and to certain fleet management personnel. The briefs are packaged daily and transmitted to the fleet training office, the torts division of the fleet law department, and the safety department. It is important to note that the brief contains only summary information about the incident before any investigation has taken place. It does not contain information regarding fault or preventability. In the NYCT, the safety department has responsibility for fleet benchmarking and performance appraisal as well as internal and external statistical reporting. The brief is the primary data source for this function.

If subsequent investigation determines that any of the information recorded in the brief is incorrect or incomplete, a revised brief is created that replaces the original brief. Revised briefs are necessary relatively infrequently (for fewer than 5 percent of incidents).

BRIEF NO: ENY01177 ACC CODE: 2AAAAAAA DATE OCC: 05/28/87 TIME: OCC: 1100
DIVISION: Brooklyn ROUTE: B10 - New Lots Avenue RUN NO: 5
DEPOT: East New York DESTIN: HOPKINS ST & SUMNER AVE SIDE: Near Side
ON: New Lots Avenue AT: Livonia Avenue
PRIM VEH: 1266 SCHOOL TRIP NO. ____ TOUR OF DUTY: ____
VISIB: Daylight ROAD COND: Dry DELAY TO SER: 12 DELAY TO BUS: 35
OP NAME: Smith OP PASS: 812345 OP BADGE: 44354 OP BIRTH: 03/23/55
TITLE (IF NOT OP):_____ POLICE : (NAS) OP HIRE: 08/12/79
STUDENT: _____ ST PASS: _____ ST BADGE: _____ ST BIRTH: __/__/__
SUV PASS: 455987 SUV: (AS) ST HIRE: __/__/__
SUV TITLE: SLD BUS: GARAGE NOTIFIED: Control Desk NO. PSNGR.: 22
DAM PRIM VEH: Slight DAM SEC. VEH: Moderate SEC VEH LIC # ABC123 NY
RECD DAT/TIM: 05/28/87 1230 TRAN DAT/TIM: 05/28/87 1300 INITIAL: ABC
Collision-Vehicle
ACTION OF PRIMARY VEHICLE / Forward / Moving in lane
ACTION OF SECONDARY VEHICLE / Forward / Moving in lane
RELATIVE POSITIONS / Other vehicle ahead
CONTACT POINT ON PRIMARY VEHICLE / Front
CONTACT POINT ON SECONDARY VEHICLE / Front
TYPE OF PRIMARY VEHICLE / Bus
TYPE OF SECONDARY VEHICLE / Auto (Jimmy, and so on)
*TOT INJURY: 2
M/23 – Primary Veh. – Treated at scene
F/45 – Sec. Veh. or Ped. – Removed to hosp
*Tot Fat: 1
M/55 – Sec. Veh. or Ped. —
Secondary vehicle failed to observe red signal and entered intersection as bus was entering intersection.

FIGURE 1. Example of a brief (*Source:* Musal 1994)

Even though these events may not be of interest for fleet benchmarking and performance appraisal, they are of interest to other areas of fleet management, and consideration might be given to expanding the fleet accident-reporting system to become a fleet incident-reporting system. Case Study 1 describes a sample fleet accident-reporting system.

The person responsible for fleet benchmarking and performance appraisal must determine which of the reported incidents are to be recorded in the accident record-keeping system.

Before moving on to a discussion of accident record keeping, it is appropriate to discuss the establishment of criteria for including reported incidents in an accident record-keeping system.

One of the pioneers of the industrial safety movement in the United States, H. W. Heinrich, introduced the concept of the accident pyramid in 1931. According to Heinrich, for every major accident (serious injury or death) there were 29 minor-injury accidents and 300 no-injury accidents (property damage or disruption) (Heinrich 1969).

As the subject of his doctoral dissertation in 1963, William E. Tarrants added a new, broader-base layer to Heinrich's pyramid. Tarrants realized that analysis of the number of accidents was not an effective preventive technique for small work units. Due to statistical constraints, several years' worth of accident records would have to accumulate before any meaningful statistics could be generated. Tarrants interviewed workers in a small work unit to identify critical incidents—events that could have resulted in an accident but by luck did not. He gathered sufficient information about critical incidents to perform meaningful statistical analysis so that he could direct efforts to prevent accidents (Tarrants 1963).

The main purpose of fleet benchmarking and appraisal should be to direct accident prevention efforts so they will have maximum effectiveness. Comparison of fleet accident experience with appropriate benchmarks shows how safe a specific fleet is compared to similar fleets. This will show the need for additional accident-prevention efforts. Only through accident record keeping and analysis can comparisons be made of accidents experienced before and after a safety initiative so that the effectiveness of that initiative can be determined. The more incidents in the accident record-keeping system, the more precise statistical analyses can be, so there is a rationale for including as many accident or near-miss events in the accident record-keeping system as possible.

There are other factors to consider. A conscientious operator or supervisor who meticulously reports every critical incident may be considered to have a poor safety record compared to that of a colleague who successfully hides many accidents. There is a strong incentive for both operators and local supervisors to avoid reporting accidents if they think they can get away with it. Above all, the accident-reporting and record-keeping system must be fair.

Reporting of critical incidents may be especially useful in a small fleet where the emphasis is on safety and not discipline. The practice of examining each fleet vehicle for damage every time it returns to the dispatch location or changes drivers is a good way to ensure that every accident is reported.

Whatever threshold is set for recording incidents, it is always possible to maintain nonrecordable incidents in the record-keeping system for use in statistical analyses even if they are not counted for internal and external reporting purposes. Knowing that critical incidents will not count against their safety record is an incentive for operators and supervisors to report them.

Some fleet safety officers (in the author's experience) believe that preventability by the fleet operator should be a criterion in determining whether an accident is recorded. There is certainly a strong incentive for both the safety officer and fleet management to not record incidents unless the fleet operator is found to be at fault, because if fewer accidents are recorded, the fleet's safety record appears to be better. The author disagrees with this position, because even accidents the fleet operator could not prevent might result in injury, damage, and disruption of fleet activity, and the elimination of preventability by the fleet operator as a criterion removes a subjective variable from statistical analysis and makes the accident record-keeping system more complete. Also, recording the accident but noting that the operator was not at fault puts the fleet in a stronger legal position should a lawsuit follow an incident.

Accident Record Keeping—Designing a System

The author's first involvement with accident record keeping occurred before personal computers were introduced into the office environment. He vividly remembers being part of a team of five employees searching through piles of paper accident reports to determine how many of a certain type of vehicle accident happened in the previous year to answer a top management question.

Development of a computer-based accident record-keeping system is necessary with a large fleet, because manual searches through accident records are very time-consuming. While it would be possible to use a spreadsheet program such as Microsoft Excel to record incidents, a database program such as Microsoft Access is more suited for use when organization policies require report generation, statistical analysis, and searching for incidents or trends. Both of these programs are frequently provided as part of the software package on office computers. The person responsible for accident record keeping must become familiar with the capabilities and basic operations of the database program selected to support the accident record-keeping system.

The first step in creating an accident record-keeping system is choosing the data elements to be recorded. Figure 2 provides a suggested list of data elements to consider. This list should not be considered comprehensive; additional elements may be added or removed depending on the scope of the system (see discussion below).

No matter how much thought is put into developing an accident record-keeping system, some odd incident will occur that will provide a record-keeping challenge. The data elements in Figure 2 are intended to capture information about a typical two-vehicle collision, but what if more than two vehicles are involved? A suggestion is to collect information on the first vehicle to collide with the fleet vehicle (no matter where that vehicle falls in the chain of events in the overall accident). Include the total other vehicle injuries and fatalities in the secondary vehicle numbers. If the fleet vehicle collides with two or more other vehicles simultaneously, pick the one with the most serious injuries or damage to record. Other potential events to consider are pedestrian accidents, collisions with objects, noncollision accidents involving passengers on the fleet vehicle, and employee accidents on the fleet vehicle.

As was previously mentioned, there is a possibility that information gathered within the fleet accident record-keeping system may overlap information in other record-keeping systems. It is also possible that information reported, such as crimes, witnessing of events, and other miscellaneous occurrences, while not useful to the fleet safety benchmarking and performance appraisal system,

Data Element	Explanation
Date	Date of incident
Time	Time of incident (suggest using 24-hour time)
Work unit	Dispatch location of fleet vehicle
Driver	Identity of operator of fleet vehicle (employee number or name)
Driver demographics	Date of birth, date of hire, gender, and so on, for possible use in statistical analyses. This information might be acquired by linking with a personnel database.
Primary vehicle number	Identity of the fleet vehicle
Primary vehicle type	E.g., bus, truck, car
Primary vehicle point of impact	E.g., left front, front, right front. Consider using a numbered diagram instead of wording to identify.
Primary vehicle action	What the fleet vehicle was doing at the time of the incident (e.g., stopped in traffic, stopped at curb, starting forward, moving forward, turning left)
Driver of secondary vehicle/ pedestrian	Identity of other vehicle operator
Registered owner of secondary vehicle	Identity of other vehicle owner
Secondary vehicle/object type	E.g., bus, truck, car, emergency vehicle, other fleet vehicle, bicycle, pedestrian
Secondary vehicle point of impact	E.g., left front, front, right front. Consider using a numbered diagram instead of wording to identify.
Secondary vehicle/pedestrian action	What the other vehicle/pedestrian was doing at the time of the incident
Relative position of vehicles/ object/pedestrian	E.g., other vehicle ahead, other vehicle behind, other vehicle overtaking and passing, other vehicle approaching from left
Fleet employees injured, primary vehicle	Number of employees injured
Fleet employees killed, primary vehicle	Number of employees killed
Other injuries, primary vehicle	Number of passengers injured
Other fatalities, primary vehicle	Number of passengers killed
Injuries secondary, vehicle/ pedestrian	Number in other vehicle injured
Fatalities secondary, vehicle/ pedestrian	Number in other vehicle killed
Damage, primary vehicle	Estimated dollar value or subjective estimate (e.g., none, minor, moderate, severe)
Damage, secondary vehicle/ object	Estimated dollar value or subjective estimate (e.g., none, minor, moderate, severe)
Geographical location	E.g., nearest intersection, milepost. Consider using a mapping program to provide precise longitude/latitude.
Number of passengers on primary vehicle	To assist law department; occasionally more lawsuits are filed claiming injury than there were passengers on the bus
Demographics on injured persons	Age, gender (to assist law department)
Identity of responders	E.g., police, ambulance
Detailed narrative of accident	Include potentially useful information that doesn't fit elsewhere.

FIGURE 2. Vehicle accident record-keeping system data elements (*Source:* Musal 1994)

might be useful to other areas of fleet management. The administrator of the fleet accident record-keeping system should communicate with the administrators of other record-keeping systems within the fleet and coordinate management of information sources and record keeping for mutual benefit. Case Study 2 presents a sample fleet accident record-keeping system. The details of the coding system are provided in the Appendix.

BENCHMARKING

Perhaps the most difficult task of fleet benchmarking and performance appraisal is to determine what benchmark, or benchmarks, to use. ANSI Z15.1 *Safe Practices for Motor Vehicle Operations* (ANSI 2006) establishes incidents per million miles as a standard rate for comparing motor fleet accidents, but what does the person responsible for fleet safety performance appraisal compare against? There are many possible answers to this question.

The National Safety Council's *Injury Facts*, published annually, provides a wealth of accident statistics for possible use in benchmarking. Incidence rates per million miles are presented in it for many types of fleets. In addition, industry-specific organizations may provide statistics for benchmarking comparisons. Membership in the Network of Employers for Traffic Safety (NETS) allows fleet participation in their benchmarking efforts. Even within the same industry, the selection of benchmarks may be difficult. Is it fair to compare a fleet of eighteen-wheelers with a fleet of smaller trucks? Is it fair to compare a fleet of articulated buses with a fleet without such vehicles? What about a fleet with mixed vehicle types?

Can the fleet accident rate of a post office delivering primarily to RFD routes with dirt roads be compared with a suburban post office delivering to town houses on well-paved roads? Traffic density is another issue. NYCT accident rates for Queens and Staten Island depots, which have relatively low traffic density as well as express routes on superhighways that provide many miles to the denominator of the equation, always have significantly lower accident rates than Manhattan depots providing crosstown service, where it may take as much as an hour to traverse the two-mile-wide island in very dense stop-and-go traffic. Is it fair to use a Queens or Staten Island accident rate as a benchmark for a Manhattan bus depot? Of course not.

Another confounding variable in using accident rates from other fleets as a benchmark is the use of different accident record-keeping methodologies. (In the Accident Reporting section of this chapter, this issue was raised during the discussion of preventability being used as a factor in determining whether an incident should be recorded.) While the NYCT did not use preventability as a factor in determining whether to record bus traffic accidents, the author discovered that several other transit properties in the United States did not report accidents that they determined were not their fault. NYCT accident rates are compared directly with the accident rates of other fleets in American Public Transit Association (APTA) safety contests and are published alongside the rates of other fleets by the Federal Transit Administration (FTA).

CASE STUDY 2

Overview of a Sample Accident Record-Keeping System

This case study presents the fleet incident record-keeping system of the bus operation of NYCT and is based on an unpublished master's thesis by the author (1994).

A database was set up to accept most of the information suggested in Figure 2. Rather than establish multiple fields or have a narrative to describe the incident, an eight-character coding system occupying one field in the database was established for accident classification. The details of this coding system are provided in the Appendix. The structure of the coding system is summarized in the table.

Coding System

Type	Character 1	2	3	4	5	6	7	8
Collision pedestrian	1	Primary vehicle action	Pedestrian action	--	Primary vehicle contact point	--	Primary vehicle type	--
Collision vehicle	2	Primary vehicle action	Secondary vehicle action	Relative positions	Primary vehicle contact point	Secondary vehicle contact point	Primary vehicle type	Secondary vehicle type
Collision object	3	Primary vehicle action	--	--	Primary vehicle contact point	--	Primary vehicle type	Object type
Passenger	4	Primary vehicle action	Passenger action	Passenger location	Event	--	--	--
Crime	5	Crime category	Crime details	--		--	--	--
Misc.	6	Misc. category	Misc. details	--		--	--	--

The structure of this coding system makes it easy to select accidents when either responding to inquiries or performing detailed statistical analyses. For example, pedestrian accidents may be found by selecting all records with a first character of "1." Collisions with taxis would be found by selecting all records with the eighth character "J." Collisions involving the right front of the fleet vehicle would be found by selecting all records with the first character "1," "2," or "3" and the fifth character "F."

The most accurate benchmark is often a fleet's own prior history unless the fleet changes its accident record-keeping methodology. Many of the variables mentioned above are eliminated if a work unit's own history is selected as a benchmark. There are, however, still variables that must be looked at in considering a fleet's own history as a benchmark. Seasonality is one important factor. Aside from weather conditions, there may be other seasonal issues. For example, as birds migrate, so do some people, and traffic conditions in the southern parts of the United States may be heavier in the winter than in the summer. When school is in session, the presence of school buses may appreciably increase traffic density. Special factors, such as a heavy snowstorm, temporary construction traffic patterns, or the occurrence of a special activity, such as a political convention, may drastically alter accident statistics. Such issues should be addressed in the notes presented with statistical reports.

While the most accurate benchmark may be the fleet's own prior experience, totally neglecting the experience of other fleet operators would be a serious mistake. Continued comparison of a fleet that has an abysmal safety record with its own record alone would provide little incentive to improve. Such benchmarking would perpetuate poor safety performance. Selection of benchmarks outside the fleet must be made with care, understanding the limitations of using such benchmarks.

The United States has adequate fleet accident-reporting systems, public and nonprofit, as described earlier. There is, however, little fleet safety benchmarking information available for many other countries (P.A.U. Education 2005). Case Study 3 shows how one company developed fleet safety benchmarking information where little was available.

Even where international data is available, it may be difficult to make proper comparisons due to differences in data-collection methodologies, population distribution, and traffic conditions. This is illustrated in "Benchmarking Australian Bus Safety" (Hildebrand and Geoff 2002), a study that compared bus accident rates in Australia with those in the United States and Canada. This study found that the bus fatality rate per kilometer in Australia is about 50 percent of that in Canada or the United States. However, the population-based fatality rate among bus passengers is more than ten times that in the United States or Canada. Lumley General Insurance of Australia provides statistical information on fleet accidents to clients. Included is information on how each client compares to other clients. Lumley also provides training materials and safety giveaways to clients, but believes the benchmarking initiative is their most effective tool (Haworth et al. 2000).

Prompted by unusually high fleet accident costs in 2006–2007, the British Royal Mail conducted a benchmarking audit, comparing their fleet safety practices to British Telecom, British Gas, and other organizations. They found that while they had good vehicle safety practices and reporting of accident information, they were deficient in driver assessment. Subsequently, they improved driver risk assessment, including license checks and installing telemetry in vehicles to identify driver performance (Murray and Keeler 2008).

The preceding discussion of benchmarking has been confined to vehicle accidents. It should be noted that ANSI Z15.1 provides a means for calculating incidence rates for other fleet operations. For example, delivery vehicles or dump trucks might use the *number of incidents per 10,000 deliveries made* or *number of incidents per 10,000 loads carried*, and fleets carrying passengers might use the *number of incidents resulting in passenger injury per million passengers carried.*

Benchmarking must be done with caution. While a fleet's own previous accident experience may be the most accurate benchmark, other benchmarks should also be considered, comparing judiciously and taking confounding factors into account.

CASE STUDY 3

Fleet Safety Benchmark Survey: Europe, Middle East, and Africa

The Europe, Middle East, and Africa (EMEA) division of the Johnson & Johnson Company realized there was little data available for fleet safety benchmarking in their geographic area, so it conducted a survey to develop such data. Initially pharmaceutical companies in the area were included, but the scope was expanded to include medical and consumer products companies. In all, 23 multinational companies participated in the survey.

For the calendar year 2004, vehicle mileage and accident data, safe driving programs, and environmental and risk management issues were included in the survey for all of the respondents' operations in Europe, the Middle East, and Africa.

The survey was initiated with three conference calls during which the questionnaire was explained and questions responded to. A second similar survey, which is global in scope, was begun in May 2006 (P.A.U. Education 2005).

Statistical Analysis

An intensive study of statistical analytical methods is beyond the scope of this book. Many statistical tests have been developed to perform all sorts of different analyses. It is important for the statistician to understand exactly what is to be measured and the limitations of the statistical test proposed. It is quite possible for different statistical tests to result in what appear to be contradictory findings. Having said this, it is necessary to use some statistical analysis techniques when carrying out performance appraisals.

Whether it is intended to compare one work unit with another within the fleet or to compare the fleet's accident experience with that of another fleet, it is necessary to consider the activity of the fleet as well as the number of accidents.

The most frequently used standard rate for comparing fleet accidents is *accidents per million miles traveled.* This is calculated by multiplying the number of accidents recorded (see discussion on recordable accidents in the Accident Reporting section of this chapter) by one million and dividing the result by the number of miles traveled by all vehicles in the work unit (see Case Study 4 for a sample calculation). Other rates noted in the Benchmarking section are similarly calculated using the appropriate incidents and the constant specified in the rate instead of 1,000,000.

Now that an accident rate has been calculated, the accident experience of one fleet work unit (or a whole fleet) may be directly compared with that of another. Such comparisons should be considered carefully, as there are many possible confounding variables, such as traffic conditions, weather, and different vehicle types, that would make the comparison invalid.

One note of caution: it is not statistically proper to add or average rates. Once rates have been calculated for subsidiary work units, do *not* add or average the rates. Each accident rate must be calculated separately using the incidents and miles traveled (or deliveries made or passengers carried) for the work unit being examined.

As has been noted in the Benchmarking section, the author recommends a work unit's own accident record as an appropriate benchmark because it is likely that using it will introduce the fewest confounding variables. The use of the unit's own record as a benchmark facilitates an ongoing analysis of the effectiveness of accident prevention efforts within that unit. One very useful tool to perform this analysis is the *control chart.*

Accident occurrences vary daily. This variation may be due to chance or some extraneous factor, such as a snowstorm or the implementation of a safety initiative that may have caused the accident rate to go up or down.

CASE STUDY 4

To calculate the standard rate for comparing fleet collision accidents, first, determine the work unit for which the rate is to be calculated. Almost any work unit may be selected; it could be one vehicle, one driver, one route, one dispatch point, or the whole fleet. Next determine the time period for which the rate will be collected: a day, a month, a year, and so on. Then identify the number of recordable collision accidents and the cumulative number of miles all vehicles in that work unit traveled.

For example, for a given work unit and time period, assume that there were three recordable collision accidents and the total number of miles traveled was 50,000. These numbers are put in the following equation:

$$\text{accidents per million miles} = \frac{\text{accidents} \times 1{,}000{,}000}{\text{miles traveled}} =$$

$$\frac{3 \times 1{,}000{,}000}{50{,}000} = 60 \text{ accidents per million miles}$$

A control chart uses statistical techniques to measure each individual time unit (day, month, and so on) against all other similar time units included within the calculation. A statistical technique is used to set control limits at levels of statistical significance [e.g., 95 percent confidence interval—approximately two standard deviations (actually 1.96) above and below the mean, or 99 percent confidence interval—approximately three standard deviations (actually 2.576) above and below the mean]. After application of this statistical technique, the user may state that any data point above the upper control limit or below the lower control limit was influenced by a factor other than chance with 95 percent (or 99 percent) certainty. Regular use of the control-chart technique is especially useful in measuring the continued effect of a particular safety initiative. Does the initiative result in a permanent accident reduction, or is its effect temporary?

A word of caution: before attempting to use a control chart, one should understand some fundamental statistical concepts, such as a normal distribution, probability distribution, and standard deviation.

Before introducing the preparation of a control chart, a brief discussion of time intervals and statistical significance is helpful. Statistical calculations by their nature are estimates. For example, in the previous paragraph the reader was given choices of 95 percent or 99 percent certainty; statistical analysis used as an estimating tool does not provide 100 percent accuracy. The more data points within a statistical analysis, the more accurate it will be, because the number of values is one of the

factors used in determining the accuracy of the statistical calculation. Thus, a weekly analysis (with seven days of accidents) will be more accurate than a daily analysis (with only one day of accidents), and a monthly analysis (with 28 to 31 days of accidents) will be more accurate than a weekly analysis. Using longer time periods reduces variability, thereby allowing control limits to be tighter so that developing trends may be identified earlier.

Besides selecting the time period measured (day, week, month), it is also necessary to select the time interval used to establish the control limits. This selection should be made based on what the chart is intended to show. If the intention is to show the long-term effectiveness of the implementation of a safety initiative started several years in the past, it may be appropriate to create a control chart showing yearly accident rates over a period of twenty or more years. If the effectiveness of a current safety program is being evaluated, it may be more appropriate to start the control chart after the previous safety initiative was fully implemented and use monthly intervals. If the intention is just to watch accident statistics to see if any trends develop, 24 months is suggested, with monthly data points.

The formulas for calculating the upper control limit (UCL) and the lower control limit (LCL) at the 95 percent confidence level are

$$\mathrm{UCL} = \bar{p} + 1.96\sqrt{\frac{\bar{p}(1-\bar{p})}{n}} \quad (1)$$

$$\mathrm{LCL} = \bar{p} - 1.96\sqrt{\frac{\bar{p}(1-\bar{p})}{n}} \quad (2)$$

where

$\bar{p}$ = sum of $\frac{\text{accidents}}{n}$

n = sum of miles traveled

Depending on the accident rate used, the value for n might also be the sum of passengers carried, deliveries made, and so on. Should the 99 percent confidence level be desired, substitute 2.576 for 1.96 in the above equations (Tarrants n.d.). The numbers 1.96 and 2.576 are used because those are the numbers of standard deviations required for the 95 percent and 99 percent confidence intervals, respectively. These numbers are derived from the standard normal (z) distribution table, which shows the areas under a normal curve for different numbers of standard deviations from the mean. Any number of standard deviations may be selected based on the degree of accuracy desired.

Case Study 5 is presented to show the calculations necessary to prepare a control chart with a 95 percent confidence level for vehicle accidents based on miles traveled in a work unit. The data are fictitious. An interpretation of the control chart is also presented with fictitious events used to explain any anomalies.

The primary purpose of accident record keeping and analysis is for performance appraisal and benchmarking. Occasionally, however, it is necessary to use these tools to evaluate the effectiveness of accident-prevention efforts. The accident record-keeping database becomes a useful tool in performing these analyses. Depending on the situation, it may be necessary to perform a prospective or retrospective study, and the appropriate statistical tests must be selected. A prospective study is one in which the ground rules of the study are set and participants are selected before the study is begun. A retrospective study is one in which preexisting data is used for the study. Care must be taken in establishing the ground rules of the study to eliminate or reduce confounding variables and to ensure the validity and reliability of the findings.

Case Study 6 presents an analysis of the effectiveness of an accident-prevention effort. No documentation of this study remains; its description is based on the author's memory only. The presentation focuses on the methods followed in setting up the study rather than the exact statistical techniques used in the study.

It would not be appropriate to conclude this discussion of statistical analysis without touching on nonstatistical analysis—specifically, the human element. People processing accident reports sometimes notice odd things or come up with ideas that can be very productive in reducing accidents. Hence, Case Study 7 is presented.

Statistical Reporting

Maintaining accident statistics is valueless unless something is done with them. Their use in initiating and measuring accident-reduction efforts has already been discussed. Accident statistics are also reported as a measure of work-unit safety. Such reports may be made to entities outside the organization as well as those inside the organization.

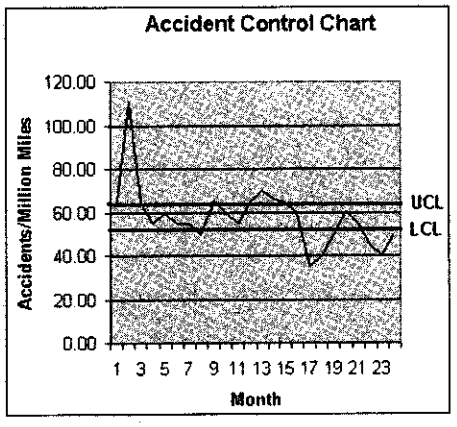
Certain motor fleets may be required to report accident statistics to regulatory agencies. For example, public transit properties are required to submit annual statistical reports to the Federal Transit Administration (FTA). Most business organizations are also required to make annual reports of employee accident statistics to the Occupational Safety and Health Administration (OSHA). Local public agencies often must report employee accident statistics to regulatory bodies similar to OSHA.

CASE STUDY 5

Preparing a Control Chart

This case provides a chart showing fictitious data for a fleet unit and the calculations necessary to prepare the control chart.

The individual monthly data points as well as the upper and lower control limits may then be plotted on a line graph.



Time Interval	No. of Accidents	Miles Traveled	Accidents Per Million Miles
1	13	200,923	64.70
2	21	190,013	110.52
3	13	201,198	64.61
4	11	200,201	54.94
5	12	201,989	59.41
6	11	200,805	54.78
7	11	199,879	55.03
8	10	199,987	50.00
9	13	200,113	64.96
10	12	201,198	59.64
11	11	200,098	54.97
12	13	201,175	64.62
13	14	200,123	69.96
14	13	197,013	65.99
15	13	201,213	64.61
16	12	200,197	59.94
17	7	201,112	34.81
18	8	200,891	39.82
19	10	199,979	50.01
20	12	199,998	60.00
21	11	200,250	54.93
22	9	201,213	44.73
23	8	200,118	39.98
24	10	201,200	49.70
Sum	278	4,800,886	57.91
$\bar{p}$	5.7906E-05		
$\frac{\bar{p}(1-\bar{p})}{n}$	1.20608E-11		
$\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$	3.47287E-06		
$1.96\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$	6.80682E-06		
UCL	6.47128E-05		64.71
LCL	5.10992E-05		51.10

It is now necessary to interpret the control chart in light of (fictitious) events that happened related to the work unit under examination. Months 1 through 24 represent January of the first year through December of the second year. The spike in month 2 represents a very snowy February of year 1 with icy road conditions through much of the month resulting in more accidents than usual. The ticks below the lower control limit in month 8 and above the upper control limit in month 9 are unexplained. A 95 percent confidence level was chosen, so it is possible that some points outside the control limits are due to chance. Had a 99 percent confidence level been used in the calculations, both of these points would have been within the control limits. Note that due to the relatively small size of the work unit, only about three accidents separate the lower control limit from the upper control limit. Had the monthly number of accidents varied more widely than those presented here, the control limits would have been farther apart because the standard deviation would have been greater. Months 13 and 14 represent January and February of year 2 with snow and ice again, but not as severe as in year 1. In month 17, the safety director implemented an incentive program focusing on accident reduction. There was a significant reduction in accidents for three months, but the novelty of the program wore off (see discussion of incentive programs) and things were back to normal in month 20. In month 22 the traffic department installed a traffic light at an especially dangerous intersection that most fleet vehicles had to pass through. This resulted in a permanent drop in traffic accidents to a new lower plateau. Month 22 would be a logical starting point for a future control chart because it represents a permanent change in traffic conditions that makes prior data a poor benchmark.

Members of the National Safety Council (NSC) are requested to voluntarily report their accident statistics to the NSC. These statistics are amalgamated and presented in the NSC's annual publication *Injury Facts*, previously mentioned in this chapter. Members with especially noteworthy accident records receive recognition from the NSC. Industry groups, such as the American Public Transit Association (APTA), also collect accident statistics from members for publication within the industry. Again, fleets with excellent safety records receive recognition.

Publications from and inquiries for statistical information from all of these organizations become sources of information fleets can use to develop benchmarking criteria to measure their overall safety. Care must be taken in selecting benchmarking criteria (see the discussion on benchmarking earlier in the chapter).

Finally, and perhaps most importantly, accident statistics are reported internally to management. They become a tool local management can use to measure their success in safety. Statistical reports may also be among the measures used to rate managers for promotions and possible bonuses. For these reasons it is especially important that accident-reporting, record-keeping, and analysis systems be above reproach (see the discussion on criteria for recording accidents in the Accident Reporting section of this chapter).

An internal fleet accident statistical reporting system may include charts and graphs showing accidents geographically by fleet unit and showing accident trends by time. Accidents may be presented as raw numbers and/or as rates (see Case Studies 4 and 5).

CASE STUDY 6

Analysis of the Effectiveness of an Accident-Prevention Effort

This case study presents a real accident-prevention effort at the NYCT. It is drawn from memory, as no documentation of the study remains.

Statistics showed that collisions involving the bus rear represented a significant number of accidents. A suggestion was made that if the bus rear were to be more visible, fewer vehicles might collide with it. Further investigation revealed two possible ways to make the bus rear more visible. One was to paint the rear with chevron-shaped alternating yellow and black stripes ("zebra stripes"), as is done with some construction vehicles. A second was to install a third brake light (a "cyclops light") below the rear window of the bus and centered above a horizontal line drawn between the two existing brake lights.

Discussions were initiated with the bus operations and maintenance departments. They agreed on a preliminary test protocol for a prospective matched control study calling for participation by four bus depots: one each in Queens and Staten Island, which serve areas with relatively light traffic conditions, and one each in Brooklyn and the Bronx, which serve areas with heavy traffic volume. Thirty regular buses were to be chosen at random from each depot. (This test excluded high-mileage express routes that used a different type of bus and included significant amounts of highway travel.) All 120 buses were to have rear advertising signs removed because the signs were a potentially confounding variable. Ten buses at each depot were to be repainted with zebra stripes, ten were to have the cyclops light installed, and ten were to remain as is (with the advertising signs removed). The study was to last one year.

The concept of removing the advertising signs from the buses brought vehement objections from the real estate department, which produced revenue from renting space for the signs. Negotiations resulted in an agreement that only the 20 zebra-striped buses would have their advertising signs removed, and the signs would remain in place on the other 40 buses. Should the zebra stripes prove effective in reducing rear-end accidents, further discussion would take place with the real estate department.

After the buses were prepared, the study began. The test buses were randomly assigned to routes and drivers using regular procedures at the depots. Test buses withdrawn from service for more than a few days due to accident damage or mechanical breakdown were replaced by other regular buses selected at random from the same depot and prepared appropriately. On a monthly basis all accidents involving the test buses where the point of impact was either left rear, rear, or right rear (see the Appendix for coding structure) were abstracted from the accident record-keeping system, and copies of the accident brief were maintained in a separate file for the duration of the study. Special procedures were established to obtain monthly mileage counts from each depot for the buses in the study.

At the end of the first month of the study it was noted that the zebra-striped test buses had more rear accidents than the other test groups. Approximately four months into the study, sufficient data had been collected to indicate that the zebra-striped test buses had significantly more rear accidents than the other test groups. At that point a decision was made to withdraw the zebra-striped buses from the study, have them repainted, and have the advertising signs remounted. This resolved issues with the real estate department.

The study continued with only two test groups. Analysis of the results at the conclusion of the twelve-month test period showed the cyclops-light-equipped buses had significantly fewer rear collisions than the control group. The study results were presented to management. Management determined that all future new bus orders would include the requirement that a cyclops light be factory installed. Moreover, management directed that all existing buses be retrofitted with a cyclops light.

CASE STUDY 7

Bus Operators Falling from Doors

This case study presents a real event at the NYCT. It is related from memory, as no documentation remains.

The person responsible for classifying employee accidents noted that several incidents had been classified as "bus operator falling from door." This was identified from the NYCT employee accident record-keeping system, which has not been described here but was fully described in *The Development of an Accident Record-Keeping System at the New York City Transit Authority* (Musal 1994). Why do bus operators fall from the door of a bus? Interest was piqued and further investigation of accident records and a visit to a bus depot resolved the mystery.

For safe driving, it is necessary that both right and left outside rearview mirrors be properly adjusted for the height and seat position of the driver. Accordingly, when drivers enter a bus, the first thing they adjust is the seat and the second is the mirrors. It is easy to adjust the left outside mirror by opening the window and manually moving it. The right outside mirror is more difficult. The driver sits in the seat, looks at the mirror, estimates how it must be adjusted, and then opens the front door of the bus and places his or her left foot on the door hinge while grasping a railing with his or her left hand. The right hand adjusts the mirror while the right foot moves in the air, trying to maintain balance. The driver then returns to the seat to check the mirror position and repeats the adjustment process as necessary.

As is known from ladder safety rules, three points of secure contact are required for safety. Drivers have two secure points: left foot and left hand, making mirror adjusting less than safe. Two additional factors make the mirror-adjusting operation even more unsafe. A properly maintained door hinge is well oiled or greased, and therefore slippery. Also, quite often bus drivers relieve other drivers on the road, not in the depot, and in winter ice and snow tend to accumulate on the door hinge.

The findings of this study were presented to management along with a recommendation that small servomotors be attached to the right outside mirrors to permit them to be adjusted by the driver from the seat. Management directed that all future bus orders have servomotors factory installed.

Incentive Programs

The use of incentive programs as accident-prevention tools is somewhat controversial in the safety profession. Because such programs raise safety awareness, they do prevent some accidents. Their continued effectiveness requires constant effort to keep employees interested. Where funding is limited, incentive programs must take second place to efforts to ameliorate unsafe conditions.

The effectiveness of incentive programs has come to be linked to an industrial research phenomenon known as the "Hawthorne effect." From 1927 to 1932, Elton Mayo and Fritz Roethlisberger conducted research on methods of enhancing employee productivity at the Hawthorne Works of the Western Electric Company (now Alcatel-Lucent) near Chicago. The key experiment in the series occurred in the relay assembly test room, where six female employees were isolated and working conditions could be controlled. The researchers measured productivity under various working conditions: rest breaks were provided or withheld; the length of the workday was changed; temperature and lighting levels were increased and decreased. After a year of experimentation, no correlation could be discovered between the varying working conditions and the women's productivity, but productivity increased throughout the experiment. Finally, interviews with the women uncovered the secret to their enhanced productivity. They felt special because they had been chosen from all other workers in the plant. They appreciated the communications and openness to questions by the researchers. A degree of team cohesiveness developed among these six women, who became fast friends. Productivity increases had nothing to do with the test conditions. They related directly to the attention given to the employees as part of the research study and the cohesiveness and dedication that developed as a result of it (Rieger 1995).

Similarly, an incentive program as an accident-prevention tool succeeds only to the extent that employees are genuinely interested in the program and modify their behaviors to align with those promoted by the program. When that interest wanes, money spent on incentive programs is as good as thrown away.

Case Study 8 describes an incentive program in use in 1988 and 1989 at NYCT to promote employee safety.

Several studies have found that a significant number of fleets use driver incentive programs as part of their accident-reduction efforts. One study found that 70 percent of trucking firms surveyed use them (Barton and Tardiff 1998). Another found that 41 percent of surveyed fleets and 66 percent of award-winning fleets use them (American Trucking Associations Foundation 1999). Still another found that 73 percent use them (Knipling et al. 2003).

CASE STUDY 8

A Safety Incentive Program

This case study presents a safety incentive program used in 1988 and 1989 at the NYCT and is reconstructed from the author's memory.

It began as an annual program recognizing the bus maintenance shop with the best lost-time accident record. Suitable publicity announced the program before it began. After the annual accident records were compiled, a ceremony was held at the winning work location. A trophy was presented by the chief executive officer followed by coffee and cake. Coffee mugs imprinted with the winning maintenance shop's name, year, and achievement were presented to all employees.

During the second year of the program a second award was added to recognize the maintenance shop with the most improved lost-time accident record. A similar presentation ceremony was held at each winning maintenance shop. After the 1989 awards were presented, in 1990 that particular program was brought to a close and another safety initiative was implemented.

Legal Implications

Vehicle accidents often result in legal action by injured parties. To protect the interests of the employer, the custodian of vehicle accident records must be very careful in responding to requests for accident information from outside the organization.

Public agencies are especially at risk. Many public bodies are required by various freedom-of-information laws to provide their internal information to members of the public upon request, and accident information is included. Accident information may also be useful to researchers doing academic investigations. As such information is accessible to anyone, it is quite possible, and not illegal, for a person to submit a request as a private citizen without indicating in the request that he or she is an attorney representing a client. Accordingly, it is prudent for all freedom-of-information requests to be funneled through an agency's legal department.

Both public and private fleet operators may receive subpoenas requiring the presentation of accident records as part of the discovery process of a lawsuit. Upon receiving a subpoena, it is likewise important to consult with the fleet's attorney to determine how it will be handled.

The custodian of the accident records and the fleet's attorney can determine how best to handle the issue to protect both the employer and the custodian. For example, the author remembers one freedom-of-information request submitted by an attorney suing the NYCT. The request sought information to show that the specific type of accident suffered by the attorney's client had previously occurred and that the NYCT was negligent in not correcting the hazard that caused the accident. The request was worded quite broadly, requesting information for all accidents occurring during a particular period of time. After consultation with the legal department's freedom-of-information officer, the attorney was provided with precisely what he asked for, not what he wanted. The accidents he was searching for were scattered throughout the hundreds of printed pages he was given precisely in the order in which they had been entered into the computer. The NYCT successfully defended this particular lawsuit.

Conclusion

Benchmarking and performance appraisal are critical parts of an effective fleet safety program. There are several components of a benchmarking and performance appraisal system. An accident/incident-reporting system must be established to ensure that incidents are reported with adequate details. A record-keeping system must maintain easy availability of all of the accident data to facilitate analysis and reporting. Appropriate benchmarks must be selected so that fleet performance can be adequately judged. Proper statistical tools must be used to meaningfully analyze accident data. Appropriate methodologies must be used to create understandable reports of statistical results. All of the above should be accomplished with an understanding of how the total benchmarking and appraisal system might be used to prosecute or defend fleet management should legal action be commenced.

Without an effective accident-reporting and record-keeping system, there can be no safety management. Benchmarking and performance appraisal are the tools used to identify problem areas for accident-reduction efforts and to evaluate the effectiveness of those efforts.

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Appendix

Bus Fleet Incident Codes

Character 1: Incident Type

1	Collision-Pedestrian
2	Collision-Vehicle
3	Collision-Object
4	Passenger
5	Crime
6	Miscellaneous
7	Industrial (employee) accident

Collision

Character 2: All Collisions (Pedestrian/Vehicle/Object) – Action of Primary Vehicle

Forward/Reverse

A/B	Moving in lane
C/D	Changing lanes
E/F	Turning right
G/H	Turning left
I/J	U-turn
K/L	Pulling into curb
M/N	Pulling out from curb
O/P	Starting (not from curb)
Q/R	Stopping (not from curb)
S	Standing in traffic
T	Standing/parked at curb
X	Unknown

Character 3: Pedestrian Collision – Pedestrian Action

A	In street
B	On sidewalk
C	In crosswalk—crossing from left
D	In crosswalk—crossing from right
E	Not in crosswalk—crossing from left
F	Not in crosswalk—crossing from right
X	Unknown

Character 3: Vehicle Collision – Secondary Vehicle Action

Forward/Reverse

A/B	Moving in lane
C/D	Changing lanes

E/F	Turning right
G/H	Turning left
I/J	U-turn
K/L	Pulling into curb
M/N	Pulling out from curb
O/P	Starting (not from curb)
Q/R	Stopping (not from curb)
S	Standing in traffic
T	Standing/parked at curb
X	Unknown

Character 4: Vehicle Collision – Relative Positions

A	Other vehicle ahead
B	Other vehicle behind
C	Other vehicle overtaking and passing left
D	Other vehicle overtaking and passing right
E	Primary vehicle overtaking and passing left
F	Primary vehicle overtaking and passing right
G	Other vehicle approaching from left
H	Other vehicle approaching from right
I	Other vehicle approaching from opposite direction
J	Both vehicles standing (e.g., slide on ice, open door)
X	Unknown

Character 5: All Collisions (Pedestrian/Vehicle/Object) – Contact Point on Primary Vehicle

A	Front
B	Left front
C	Left side
D	Left rear
E	Rear
F	Right front
G	Right side
H	Right rear
I	Left open door (including engine door)
J	Right open door (including engine door)
X	Unknown

Character 6: Vehicle Collision – Contact Point on Secondary Vehicle

A	Front
B	Left front
C	Left side
D	Left rear
E	Rear
F	Right front
G	Right side
H	Right rear
I	Left open door (including engine door)
J	Right open door (including engine door)
X	Unknown

Character 7: All Collisions (Pedestrian/Vehicle/Object) – Primary Vehicle Type

A	Bus
B	Van
C	Truck
D	Auto (e.g., Jimmy)
E	Industrial truck (e.g., forklift)

Character 8: Vehicle Collision – Secondary Vehicle Type

A	Auto (e.g., Jimmy)
B	Van
C	Truck
D	Fleet bus
E	Fleet auto
F	Fleet truck
G	Fleet industrial truck (e.g., forklift)
H	School bus
I	Nonfleet bus
J	Taxi
K	Emergency vehicle (e.g., police, fire, ambulance)
L	Motorcycle
M	Moped
N	Bicycle or tricycle
O	Other person-powered vehicle (e.g., pushcart)
P	Animal-drawn vehicle
Q	Nonfleet industrial truck (e.g., forklift)
X	Unknown

Character 8: Object Collision – Object Type

A	Fixed object (e.g., abutment, pole, building, tree, curb)
B	Movable object on roadway
C	Movable object on sidewalk
D	Movable object elsewhere (e.g., depot)
E	Animal
X	Other

Passenger Accident

Character 2: Passenger Accident – Bus Action

Forward/Reverse

A/B	Moving in lane
C/D	Changing lanes
E/F	Turning right
G/H	Turning left
I/J	U-turn
K/L	Pulling into curb
M/N	Pulling out from curb
O/P	Starting (not from curb)
Q/R	Stopping (not from curb)
S	Standing in traffic
T	Standing/parked at curb
X	Unknown

Character 3: Passenger Accident – Passenger Action

A	Boarding
B	On board standing
C	On board walking
D	On board seated
E	On board sitting down
F	On board arising
G	On board action unknown
H	Alighting
X	Unknown

Character 4: Passenger Accident – Passenger Location

A	Front door/steps
B	Near fare box
C	Front seat area
D	Rear door/steps
E	Rear seat area
X	Unknown

Character 5: Passenger Accident – Event

A	Slipped/tripped/fell
B	Bumped into object/person
C	Struck by doors
D	Caught by doors and dragged
E	Struck by vehicle/object (part of body extended through window)
F	Object through window (not thrown)
G	Defective equipment
H	Bus fire
I	Actions of other passengers (not assault)
X	Unknown

Crime

Character 2: Crime Category

A	Robbery/larceny (theft)
B	Assault (injury or intent to injure person)
C	Criminal mischief (damage or intent to damage property)
D	Violation (no damage or injury intended)

Character 3: Crime Details – A. Robbery/Larceny

A	Robbery operator (theft with force or threat of force)
B	Robbery passenger (theft with force or threat of force)
C	Larceny operator (theft without force, e.g., pickpocket)
D	Larceny passenger (theft without force, e.g., pickpocket)
E	Larceny fleet property (theft without force)
F	Larceny fleet revenue (theft without force)
G	Larceny non-fleet property (theft without force)

Character 3: Crime Details – B. Assault

A	Other operator assault
B	Other passenger assault
C	Assault by operator
D	Operator struck by thrown object
E	Passenger struck by thrown object

Character 3: Crime Details – C. Criminal Mischief

A	Missiles
B	Graffiti
C	Other

Character 3: Crime Details – D. Violations

A	Harassment
B	Hitching (no injury)
C	Hitching (injury)
D	Hitching (fatal)
E	Other violation

Miscellaneous

Character 2: Miscellaneous Category

A Person leaving after alighting
B Person approaching to board
C Equipment damage or failure
D Involvement—passenger/other person
E Miscellaneous other
F Incident observed

Character 3: Miscellaneous Details – A. Person Leaving after Alighting

A Other fall in roadway or on adjacent ground
B Fall in bus stop zone
C Struck by vehicle in roadway—other
D Struck by vehicle in roadway—alongside bus
E Miscellaneous other and indeterminate

Character 3: Miscellaneous Details – B. Person Approaching to Board

A Other fall in roadway or on adjacent ground
B Fall in bus stop zone
C Struck by vehicle in roadway—other
D Struck by vehicle in roadway—alongside bus
E Miscellaneous other and indeterminate

Character 3: Miscellaneous Details – C. Equipment Damage or Failure

A Window/bus damage—no injury, not a crime
B Bus fire

Character 3: Miscellaneous Details – D. Involvement – Passenger/Other Person

A Illness/death on bus including sick employee
B With passenger—fare or transfer
C With passenger—other reason
D Between passengers
E With person other than passenger
F Miscellaneous other and indeterminate

Character 3: Miscellaneous Details – E. Miscellaneous Other

A Clothing soiled or damaged on bus
B Other property damaged on bus
C Miscellaneous other and indeterminate—also denial by operator

Character 3: Miscellaneous Details – F. Incident Observed

A Vehicles colliding
B Vehicle striking person
C Person falling
D Injury off bus
E Other

Industrial (Employee) Accident

Character 2: Cause

A Animal or insect
B Contact—e.g., electricity, surface, molten metal, liquid
C Fall—elevation
D Fall—surface
E Falling object
F Flying object
G Flying particle—source unknown (wind, dust)
H Gas, fume, compressed air, heat
I Handling object
J Striking object (including pothole)
K Stepping on object
L Struck by object
M Struck by train or vehicle
N Dropped operator seat (seat collapses)
O Miscellaneous
R Trip, slip, or stumble boarding or alighting from bus

Chapter 9

Best Practices

Phil Moser, Carmen W. Daecher, and Amy Stewart

LEARNING OBJECTIVES

- Understand what *best practices* means for fleet operations.
- Be able to define the risk elements associated with fleet operations.
- Know the ten steps used to develop a fleet operations' driver-safety initiative.
- Be able to define *reportable* crashes.
- Understand the classes of Commercial Driver's Licenses (CDLs) and the use of endorsements and restrictions.
- Summarize the hours-of-service rules that were revised in 2005.
- List three types of provisions of laws pertaining to CDL drivers that regulate the use of drugs and alcohol.

The term *best practices* is often heard in organizations today. In this chapter, *best practices* describes consistently applied principles and activities that have produced consistently positive results in fleet management.

Over time, many misconceptions or myths have crept into our collective thinking regarding vehicle fleets. This chapter will discuss two such myths as a prelude to the discussion of best practices. The first is that fleet managers manage vehicles. If that is all they did, fleet management would be less challenging than it is. After all, vehicles cannot talk back or offer criticism to make the fleet manager's job more challenging.

The second myth is that the lowest-cost vehicle is best for an organization. While cost is always an important consideration, the quality of the ride and the vehicle's safety features are fundamentally important to its effective and efficient use and to the employee/driver being able to operate it safely and remaining safe while in it.

Most of the myths associated with fleet management overlook a critical element in fleet operations—the driver. Most fleet-operations management systems do not fully encompass all of the risk elements associated with the operation of vehicle fleets. Because of this, the term *fleet management* is inaccurate if an organization has employees who operate fleet vehicles. *Fleet operations management* is a far better general description of the process and its challenges.

Best Practices for Risk Management of Fleet Operations

Managing fleet operations is managing risk. Best practices for managing these risks start with the identification of risk elements associated with fleet operations. They are drivers, vehicles, and operations associated with the use of vehicles.

These three elements comprise the core around which any effective management program for fleet operations is built. Not addressing any one of these elements allows risk to be uncontrolled.

Based upon this author's twenty years of experience in studying and assisting fleet operations of all sizes and types, three key management principles are important in effectively managing fleet operations:

- ***Hiring the best person for the job.*** The job description, if it includes driving a vehicle, should include consideration of driving abilities or the ability to learn the driving task effectively.
- ***Training people to succeed.*** Providing employees with the knowledge to effectively drive vehicles and understand critical behaviors associated with vehicle operations is essential to managing fleet operations. Fleet managers must ensure proficiency through repetition and/or testing during training.
- ***Managing consistently.*** With the knowledge that new employees receive, they should be expected to behave consistently according to the standards provided to them during training. Celebrating consistently good behavior and addressing unacceptable behavior are critical to keeping employees focused on behaviors that are critical in mitigating risk associated with fleet operations.

Too often, some or all of these principles are compromised. People are hired because of need rather than ability. Training is minimized or overlooked, and management is personal rather than objective. By objectively implementing and using these three key management principles, an effective and successful process of fleet operations management can be established.

A subtle but fundamentally important difference in managing fleet operations compared to other types of operations is the environment in which critical behaviors occur. In most situations, a supervisor is with employees on the floor or in the field and can identify critical behaviors and address them on the spot. Or, because of the interconnectivity between many job tasks, one employee's unsafe behavior is viewed as dangerous to the health and well-being of other employees. Thus, employees also assist in identifying and changing unacceptable behaviors.

This type of environment hardly ever exists while an employee is driving a vehicle. Usually, the driver is the captain of the ship. He or she is also the chief cook and bottle-washer. Drivers control their own destinies as well as those of others on the roadway with no direct supervision or oversight while operating the vehicle. The old paradigm *management by walking around* (MBWA) is not applicable in fleet operations. Rather, a new paradigm must be established for successful fleet operations: *management by driving around* (MBDA).

Expected Outcomes of Best Practices

With all of this in mind, best practices for management of fleet operations occur after the following components are in place:

- Enhancement of existing policies or establishment of new policies directed at fleet operations and critical behaviors associated with vehicle operations.
- Provision of adequate training to ensure that people have the proper skills to operate and maintain vehicles and understand critical behaviors and the importance of attitude and alertness while driving.
- Establishment of a progressive system of discipline for those who fail to behave acceptably. This system should attempt to refocus and retain employees rather than be purely negative in consequence. However, if employees cannot maintain consistently acceptable behavior, the company must limit the risk and liability associated with the unacceptable behavior.
- Implementation of a positive behavior-reinforcement strategy that is intended to celebrate good behavior on a regular basis and as soon as possible after such behavior is observed or acknowledged. Safety bonus programs by themselves are not always the best answer. A more fluid and interactive approach to positive reinforcement and a system in which all employees are focused on critical behaviors is more effective. The intended result of these programs is to keep people conscious of their own actions and behaviors as they drive. Positive communication may also take on the form of reminding employees of what is important as well as rewarding good behaviors after they are performed.
- Implementation of an improved fleet-efficiency program. By properly selecting and maintaining vehicles and establishing standards for their use (maximum speed, fuel usage, and so on) a more efficient and effective use of the vehicle fleet—in conjunction with vehicle performance standards that incorporate safe operation—can be established and measured.
- Revisions to organizational operations as they relate to critical behaviors and fleet efficiency. Through reassessment and adjustment to company operations that affect safe vehicle-

fleet operations (such as scheduling, routing, and provisions for replacing vehicles), company employees other than drivers and service technicians become involved in safe fleet operations. Through this process, others who influence safe fleet operations are aware of the company's commitment to safe fleet operations in combination with customer service and satisfaction and profitability.

- Establishment of a measurement and accountability process to monitor results and to help safety records to continue to improve. Regular reporting and analyzing will identify processes, policies, personnel, and other key performance items that may need change or improvement.

After an effective fleet-operations management system is in place, what should be expected? A consistently applied, effective fleet management program should produce the following sequence of results:

- elimination of poor performers
- reduced turnover
- improved communication regarding performance
- higher-quality training
- a more efficient vehicle fleet
- improved customer services and profitability
- more consistent and effective management of fleet operations

References that Can Help the Fleet Manager

The following standards, in addition to referenced publications, offer guidelines that organizations can use to shape and implement a fleet improvement program:

- ANSI Z15.1-2006, *Safe Practices for Motor Vehicle Operations* (ANSI/ASSE 2006) (for all fleet operations)
- Code of Federal Regulations (CFR) Title 49 (Parts 40, 171–180, 325, 380–399) (for commercial fleet operations)

These standards define the framework for achieving best management practices for fleet operations and detail regulatory requirements for commercial fleets. By implementing a well-defined and measurable risk-management process that also complies with all applicable regulations, an organization can achieve best practices for fleet operations.

A Ten-Step Outline for Creating a Fleet Safety Initiative

Year in and year out, traffic crashes are the leading cause of death for American workers. Annually, approximately 21 percent of worker fatalities occur as a result of motor-vehicle collisions (BLS 2011). Nevertheless, driver safety has rarely received the same level of attention as other areas of employee safety, but this is changing. Since the ANSI Z15.1-2006 standards on driver safety were published, the awareness level for driver safety has been elevated. This is great news, because in order for a problem to be corrected, there must be an awareness that the problem exists. The ANSI Z15.1-2006 standard is just one source that can be used by organizations to achieve their driver-safety goals. While many of the suggested strategies for achieving success with a driver-safety initiative are discussed in ANSI Z15.1-2006. (ANSI/ASSE 2006), the information covered in this chapter originated from the author's experiences, training, and knowledge regarding driver safety.

Many safety professionals are not familiar with the steps necessary to create a comprehensive fleet safety initiative within their organization. The following ten-step best-practices approach will help them to create a driver-safety initiative for their organization.

Step 1: Understand the Problem

In order to justify taking on a major driver-safety initiative, it is first necessary to understand the problem. This justification can begin at the national level. In 2008, according to the *Fatality Analysis Reporting System Encyclopedia* on the NHTSA Web site (NHTSA 2008), there were 34,017 fatal motor-vehicle traffic crashes. That is an average of 93 people dying every day. Early estimates for 2009 are that 33,963 people died in motor-vehicle traffic crashes, a decline of 8.9 percent from 2008, in which 37,261 people died.

Looked at in terms of risk factors, this means that one average American driver in fifteen will be involved in a motor-vehicle collision during the next year. One average American driver in forty-five will be involved in an injury collision during the next year. And one average American driver in sixty-five will be involved in a fatal collision during his or her driving lifetime. The term used for these statistics is *average American driver.* People who drive as part of their job may not be considered average. Chances are they drive quite a bit more than the *average* driver.

A National Household Travel Survey (NHTS) conducted from 2001 to 2002 by the Bureau of Transportation Statistics found that contrary to the stereotypical image of the business traveler heading off to catch a cross-country

flight, the majority of long-distance business trips in the United States are taken to destinations within 250 miles of home and are by automobile. The personal vehicle is the dominant travel mode for business travel, comprising 81 percent of all trips. Air travel accounts for about 16 percent of all business trips (BTS 2003). The average driver logs approximately 10,000 to 12,000 miles a year. The typical business driver logs approximately 25,000 miles a year. The exposure of business drivers to collisions and all of their associated risks is greater than that of the average driver—they are not *average.*

In fact, data analysis by the U.S. Department of Labor, Bureau of Labor Statistics (BLS), has shown that transportation incidents cause more work-related deaths in the United States (at 40 percent) than any other single incident type (BLS 2014). As illustrated in Figure 1, (page 16) motor-vehicle crashes were responsible for 22 percent of all worker fatalities in 2013, causing over one in five work-related deaths. The next most frequent cause of worker fatalities—contact with objects and equipment—accounted for less than half as many fatalities.

To fully understand the problem, it is necessary to look at more than just national statistics. Each organization should determine its own crash rate as well as the number of crash-related injuries, lost workdays, and workers' compensation claims that resulted from motor-vehicle collisions.

Step 2: Set Achievable Goals

The ultimate goal is to create a safe driving culture throughout an organization. Organizations that have created such a culture have had great success. As an example, in the manufacturing environment, there are some areas employees would never think of entering without the proper safety equipment, such as hard hats or eye protection, because, in this work environment, wearing protection is part of the culture. Nobody questions it. Employees adhere to these safety practices as a matter of course. This is the type of culture that must be achieved when it comes to driver safety. To reach this important overall goal, it is necessary to set achievable goals along the way. Each step listed in this chapter should be viewed as an incremental goal that is necessary to achieve a successful driver-safety initiative.

Another important goal is setting timelines for reducing the number of crashes. Quarterly, semiannual, and annual goals can be set. They should be realistic but not too easy to achieve. If an organization does not ask for quality, it will not achieve quality.

Step 3: Enlist Help

Safety professionals should seek help from people in various divisions of their organization, such as human resources, fleet management, risk management, and legal department personnel.

Human resources personnel can provide information that can justify a safe-driving initiative. They have an obvious understanding of the human element of such an initiative and can be very beneficial in trying to move it forward.

Fleet personnel see the damages and lost assets that result from motor-vehicle collisions and can also be of great assistance.

Risk-management personnel should work hand in hand with safety professionals on this initiative because managing risk is what it is all about. If an organization is insured, a reduced number of vehicle crashes has benefits in the form of reduced insurance rates. If an organization is self-insured, the savings from a reduced crash rate will improve its bottom line.

Involving the legal department provides a couple of benefits. The first is they will make sure that the initiative is within legal guidelines. The second is legal advisers can emphasize the benefits of a comprehensive driver-safety initiative from the viewpoint of exposure to litigation.

Step 4: Obtain Management Buy-In

No initiative will work if upper management is not behind it. They control the purse strings, but they also set the tone of the organization. If it is important to the boss, it will be important to the employee.

Most managers understand that creating a safe work environment is a fundamental requirement of running a successful business. Many organizations have mission statements that express the need for a safe work environment for all employees, and the driving environment should be no exception. With upper-management support, much can be done to create the safest work environment possible for employees who drive as part of their job.

In order to obtain upper-management support, it is important to look at the human element. This is where a relationship with human resources personnel is helpful. They can provide information about workers' compensation, lost workdays, and quality-of-life issues as they relate to employee motor-vehicle collisions.

The human element aside, all organizations look for ways to save money. The return on investment from a successful driver-safety initiative can be tremendous. Safety professionals should create mathematical models that take into consideration all losses caused by motor-vehicle collisions, including workers' compensation, lost productivity, litigation, and vehicle repairs and replacement, and contrast them with the savings that can be achieved with a reduced crash rate. The fiscal benefits of a driver-safety initiative will soon become apparent.

A number of companies in the United States have achieved tremendous savings as a result of their reduced crash rates (OSHA 2006).

Table 1 depicts an actual case study and Table 2 shows the savings the organization achieved.

During this six-year period, Company A's fleet grew by 534 vehicles—32 percent. At a time when the fleet's total number of claims might have been expected to increase, it actually decreased by 16 percent. In fact, during each year of the driver training, the number of claims diminished.

Total reduction in claims = 567

Total direct savings = $1,637,967

Table 2 shows the program savings . The total cost of Company A's driver training program was $542,076. The total direct savings that Company A realized were $1,637,967. This represents a savings of $1,095,891, approximately a 62 percent return on the investment.

The average cost per crash is $16,500 [quoted from the Web site for the Network of Employers for Traffic Safety (NETS)]. Another $4000 can conservatively be added to each incident to cover medical costs, lost time on the job, workers' compensation, and claims and litigation resulting from the collisions. Multiplying that number ($20,500) by the number of claims Company A avoided (567), the estimated total savings is $11,623,500.

TABLE 1

Results of a Fleet Driver Training Program

Year	Training (in $)	Number of Claims	Fleet Size	Crash Rate
Year 1	75,860	632	1664	38%
Year 2	41,442	576	1747	33%
Year 3	91,860	517	1847	28%
Year 4	141,890	525	1945	27%
Year 5	100,612	492	2054	24%
Year 6	90,412	483	2198	22%

TABLE 2

Claims Reduction and Direct Cost Savings

Year	Reduction in Claims	Average Claim Cost (in $)	Savings (in $)
Year 1	Year program started	--	--
Year 2	56	3224	180,544
Year 3	115	2695	309,925
Year 4	107	2971	317,897
Year 5	140	2851	399,140
Year 6	149	2889	430,461

Step 5: Develop Fair and Comprehensive Policies

Safety professionals must help their organizations to create fair and comprehensive driver-safety policies. These policies will evolve over time, but it is important to set a base from which to start. Policies should include driver's license requirements, standards for driver's license records checks, hiring standards, an action plan for problem drivers, training requirements, and safety incentives.

Step 6: Require Drivers' License Records Checks and Set Consequences for At-Risk Drivers

It is absolutely imperative to run drivers' license records checks on employee drivers, and systems must be in place to manage these records. The organization must also be prepared to take immediate action regarding drivers with poor driving records.

There are fifty states, and each has a different motor-vehicle code. Organizations must have systems in place that interpret their state's driving records and provide a point-scoring system for various violations. This scoring system should assign points that are appropriate to the seriousness of each infraction. For instance, a driver who has a stop-sign violation might receive two points, but one who drives under the influence of drugs or alcohol would receive ten points. There are vendors that offer this type of system.

All crash data must be recorded on employee drivers' records. Only *reportable* crashes will show up on a driver's record check. Reportable crashes are those that involve injury or death and those in which vehicles must be towed. Crashes in which nobody is hurt and the cars drive away will not show up in a driver's record check, but there are vendors that can help collect all crash data, even the data that does not show up in the records.

Once drivers receive a certain number of points, an intervention should take place that is equivalent to their level of risk. Organizations should classify drivers in three risk groups based on the number of violation points on their records. Suggested interventions are:

- Level I (smallest number of points): Consider an intervention that includes a computer-based training program.
- Level II: Consider a more active intervention such as a classroom program and a behind-the-wheel program.
- Level III: Consider termination or one-on-one training.

Step 7: Educate Drivers

Step 6 will identify and help drivers who are having problems—and encourage driver accountability. It is not possible to hold drivers accountable if they do not have

a base of knowledge regarding safe driving. Just because drivers are licensed does not mean they are safe drivers. If drivers are unaware of basic safe-driving principles, it is difficult to hold them accountable for collisions that might have been avoided had they been aware of those principles.

Organizations should provide all drivers with basic safe-driving information and keep records documenting that they received this knowledge. Once this is accomplished, drivers should be held accountable for driving safely.

Step 8: Begin at the Beginning

Statistics prove that new hires are involved in more crashes than established employees (Volpe 1998). According to this report, the crash rate for employees within their first twelve months of employment is higher than for employees who have been driving for a company longer. This stands to reason, because many of these new employees are learning new jobs in unfamiliar vehicles, possibly in unfamiliar areas. Also, many of these newly hired drivers are young people who fall within an age range that statistically has a higher crash rate than other age ranges.

For this reason, new hires should be provided with safe-driver training right from the start. This accomplishes two things: (1) they will gain some very important information that will help them to stay safe when they get behind the wheel, and (2) they will understand the tone of the organization from the beginning—that safe driving is considered very important.

Step 9: Ensure that Field-Level Managers Convey the Right Message

People who have direct managerial responsibility for an organization's drivers can make or break a driver-safety initiative. Some managers tell drivers to GO, GO, GO; others say, SAFETY, now GO, GO, GO. If safe driving is not important to a driver's immediate manager, it will not be important to that driver.

Managers should be taught that they play a vital role in helping to keep employees safe. They should have instruction on how to conduct safety ride-alongs and be required to conduct ride-alongs at least twice a year. The results of ride-alongs should be an important part of each employee's performance review. This is an extremely important part of any driver-safety initiative.

Step 10: Sustain What Is Achieved

Organizations should not waste time, money, and effort putting together a driver-safety initiative if they do not plan to sustain it. They may identify problem drivers and provide drivers with some initial training with great results, but unless they keep driver safety in front of their drivers, their results will diminish with time.

Sustaining a safe-driving initiative can be done very cost effectively. Newsletters, e-flashes, periodic testing, and recognition of safe driving are all effective measures that can be taken to help an organization maintain a safe driving record.

Addressing Safe Driving Is Worth the Effort

Addressing driver safety is a formidable but very achievable task. For organizations that have addressed driver safety and are still looking for ways to improve, this chapter will provide some assistance. Safety professionals in an organization can make a big difference in this area of safety.

Driver-Safety Policy Guidelines

The following sections should be included in a comprehensive driver-safety policy. Some may not apply to all organizations, and additional sections may be necessary for some organizations.

1.0 Purpose

This section provides reasons for the policies that help to ensure the safe operation of vehicles, including those owned or leased by the organization and those used to conduct business for the organization.

- The ultimate goal of these policies is to promote and maintain the well-being of the employees.
- By reducing the number of collisions, the risks of employee injury and death are reduced.

2.0 Scope

In this section the organization explains to whom the policy applies and what vehicles are affected. It should include company-owned, leased, and rented vehicles as well as those that are used to conduct business for the organization.

3.0 Definitions

Some definitions may clarify which employees and vehicles are affected by the policy. Others may describe serious infractions and immediate-action incidents.

4.0 Hiring Requirements

These are clear guidelines that are to be followed regarding employee license requirements and driving history, and how they affect the consideration of those applying for employment.

5.0 Driver Records Checks

Organizations must spell out Department of Motor Vehicle (DMV) check timelines. Wording should be included that makes it clear that DMV checks will be run on a regular basis and at other times when determined necessary. Wording should cover the Fair Credit and Reporting Act regulations.

6.0 Violation Point Assessments

Organizations should develop point codes that rate violations and crashes. Point codes are utilized to determine level of discipline/retraining. The point codes should reflect the severity of each type of incident.

7.0 Risk Levels

Organizations should develop a system that rates the number of points accumulated by drivers and defines risk levels based on the number of points.

8.0 Risk-Level Interventions

This policy describes the interventions that will take place for each level of risk.

9.0 Dispute of Findings

This policy sets a time during which a driver can dispute the findings of a DMV driver records check. It should specify that no record can be changed internally until the governing body that issued the record has changed the official record.

10.0 General Compliance

A general policy should be included that states all employee drivers must comply with all laws related to the legal operation of motor vehicles.

11.0 Family Members Operating Organization Vehicles

This policy states whether family members (spouses, common-law spouses, life partners, and driver-age children) may operate the organization's vehicles. If family members are sometimes allowed to operate company vehicles, the policy must specify how DMV-check regulations affect family members and how their driving records will affect whether they may operate the organization's vehicles.

12.0 Collision Reporting

This policy describes employees' responsibilities for reporting work-related collisions and other collisions involving the organization's vehicles. It should define the steps that employees must take when a collision occurs, including notification of the proper authorities and notification of the employer.

13.0 Violation Reporting

This policy should require that all moving violations be reported to the employer within a given time period, both those that occur during work time and those that occur during personal time. The reasoning behind this is that any violation that affects a person's driving record affects the person's ability to drive for the organization.

14.0 Personal Vehicle Use

Some organizations allow employees to use personal vehicles for work-related activities. This policy defines insurance and vehicle maintenance requirements and describes reimbursement policies. The organization's tax department should make sure the policy complies with all applicable tax codes.

15.0 Collision Classifications

Many organizations determine whether an employee driver could have prevented a collision. There is a distinct difference between fault and preventability. It may be found that a driver is not at fault for a collision but could have prevented it from happening.

16.0 Collision Deductibles

Some employers charge a deductible to employees who are involved in preventable collisions in organization vehicles. Some states regulate this practice and may prohibit it.

Sample Policy

The following policy is a blueprint for a comprehensive fleet safety policy. Items covered in this sample policy may not apply to every organization, and some organizations may need to add policies to address their specific needs.

1.0 Purpose

(Organization Name) is committed to promoting the safe, proper, and professional operation of all motor vehicles that it owns, leases, or rents, and any other vehicles used for (Organization Name) business. These vehicles are

operated by its employees, client employees, vendors, and other authorized operators for business and personal use.

(Organization Name) has an obligation to make sure anyone driving an (Organization Name)-owned or -leased vehicle, or anyone driving on (Organization Name) business has a valid driver's license. (Organization Name) also has an obligation to make sure that its drivers do not have a history of unsafe driving.

(Organization Name) has enacted a policy for the purpose of implementing procedures for drivers' license records checks. This policy also institutes an action plan for drivers who have a history of unsafe driving. This policy will be referred to as the *DMV Policy.*

2.0 Scope

The DMV Policy is applicable to the following:

- All persons who drive an (Organization Name)-owned or -leased vehicle for business or personal use
- All spouses who, in accordance with this policy, are permitted to drive an (Organization Name)-owned or -leased vehicle
- All persons who drive personal vehicles for (Organization Name) business
- All persons who drive any other vehicles for (Organization Name) business

3.0 Definitions

The following definitions apply to the DMV Policy:

3.1 *(Organization Name) Motor Vehicles* includes all motor vehicles that are owned, leased, or rented by (Organization Name) and any other vehicles used for (Organization Name) business.

3.2 *Drivers* refers to all persons described in section 2.0 of the DMV Policy.

3.3 *Administrative Suspension of Driving Privileges* includes any suspension of a driver's operating license as the result of administrative actions. They include nonpayment of child support, nonpayment of taxes, and any other instance that does not involve a motor-vehicle violation.

3.4 *Suspension of Driving Privileges* includes any suspension, revocation, or other loss of a driver's operating privileges as a result of a motor-vehicle violation(s).

3.5 *Preventable Collision:* A collision is preventable when it is determined that a driver's actions (or inactions) put him or her into a position in which a collision occurred.

3.6 *Nonpreventable Collision:* A collision is nonpreventable when no matter what action the driver took, he or she could not have avoided a collision.

3.7 *At-Fault Collision:* A collision is at-fault with respect to a driver when the investigating authority determines that the driver was responsible for at least 51 percent of the cause of the collision.

3.8 *Not-at-Fault Collision:* A collision is considered not-at-fault with respect to a driver when the investigating authority determines that the driver was responsible for less than 51 percent of the cause of the collision.

3.9 *Serious Driving Infractions* include the following:

- any suspension of driving privileges
- any driving-under-suspension violation
- any driving-under-the-influence violation
- any offense involving fleeing or evading police, or related actions
- any violation involving leaving the scene of a motor-vehicle collision
- any reckless driving violation*
- any homicide-by-vehicle or vehicular manslaughter violation
- any speeding violation of 30 or more miles per hour (mph) over the speed limit
- any vehicle-related misdemeanor or felony violation

*Reckless driving is included under *Serious Driving Infractions* because it is defined as "The willful and wanton disregard for safety of persons or property" (Pennsylvania Consolidated Statutes, Vehicle Code, Title 75). It is not the same as inattentive driving.

4.0 Requirements for Consideration of Employment

4.1 Scope

This section of the DMV Policy is applicable to all persons who operate vehicles within the scope of their employment with (Organization Name) and is a consideration of employment to any person who has been given a conditional offer of employment by (Organization Name).

4.2 General Requirements

- Any person who falls under the scope of this section must possess a current and valid driver's license that is issued by the controlling authority where the applicant currently resides.
- Persons who fall under the scope of this section must give written permission to conduct a check of their motor-vehicle record (MVR). The federal Driver's Privacy Protection Act (DPPA) of 1994 is the primary law governing a fleet manager's ability to collect and use employees' MVRs. Under this

law, state DMVs are restricted from disclosing personally identifiable driver records without first obtaining the driver's expressed written consent (Alaniz 2008). This is a condition of employment.

4.3 Considerations

Persons who have received a conditional offer of employment will not be eligible for employment if, within the past three years, they

- received a conviction for any serious driving infraction as defined by the DMV Policy, such as collisions for which they were convicted of driving under the influence (DUI)/driving while intoxicated (DWI).
- received three or more convictions for a speeding violation in excess of 20 mph.
- received four or more convictions for moving violations.
- were involved in more than two preventable collisions.

5.0 Driver License Records Checks

On an annual basis, or more frequently, (Organization Name) will run a check on the drivers' licenses of all individuals who fall under the scope of the DMV Policy Violations, and collisions that have occurred over a rolling three-year period will be considered for the purposes of these checks.

6.0 Risk-Level Classifications

In order to effectively manage drivers with motor-vehicle violations and/or collisions, the following risk-level classifications will be used to determine which interventions will result in accordance with each driver's activities:

0–3 points—No risk

4–6 points—Level I

7–9 points—Level II

10-plus points—Level III

7.0 Risk-Level Interventions

All interventions must be communicated to the drivers with a clear expectation for improvement.

7.1 Level I

Drivers will complete a computer-based training program that addresses the specific problems they are experiencing. This training will include testing to document the results of the training.

7.2 Level II

Drivers will complete an instructor-led, eight-hour classroom and behind-the-wheel training program that addresses the specific problems they are experiencing.

7.3 Level III

Drivers will participate in a one-on-one, full-day training session that addresses the specific problems they are experiencing. A comprehensive report will be filed that details the driver's driving habits. Level III drivers also face further disciplinary action up to and including termination of employment.

7.4 Spouse/Domestic Partner Risk-Level Drivers

Spouses or domestic partners of (Organization Name) employees who receive violations that put them in any of the risk levels outlined in this policy will not be permitted to operate (Organization Name)-owned or -leased vehicles until they have proven that they are no longer risk-level drivers.

8.0 Dispute of Findings

Once a risk-level driver is notified of the findings from a driver's license records check, he or she has 30 days to dispute the findings. To be removed from a risk-level category, a driver's violation(s) must be removed from the driver's license records by the issuing authority that posted them. If, within the 30 days, a driver notifies (Organization Name) that the violation(s) have been removed, (Organization Name) will conduct another driver's license records check. If the driver no longer falls under a risk-level category, no further action will be taken. If the driver still falls under a risk-level category, the appropriate action will take place.

(Organization Name) may remove the driver from all (Organization Name) driving responsibilities during the 30-day dispute period.

9.0 Violation Point Assessments

The following is an example of a violation-point system to classify motor vehicle violations and collisions:

9.1 No Points

Nonmoving violations, including equipment violations

Other nonmoving actions

9.2 Two Points

One preventable collision in a year

Windshield/window obstruction

Speeding (one to ten mph over speed limit)
Driving with expired driver's license
Stop-sign violations
Driving while fatigued
Red/yellow light violations
Backing-up violation
Failure to yield
Seatbelt violation
Improper lane change
Following too closely
Improper turn
Improper lane use
Improper passing
Headlight violation (nonequipment)
Disobedience of traffic devices
One-way street violation
Blocking intersection
Failure to obey police officer
Improper signaling
Littering from vehicle
Obstructing traffic
Other moving violation
Vehicle license class violation

9.3 Four Points

Driving too fast for conditions
Passing school bus
Speeding (eleven to twenty mph over speed limit)
Failure to yield to emergency vehicle
Speeding (school zone)
Unrestrained child
Inattentive driving

9.4 Six Points

Two preventable collisions in a year
Speeding (twenty-one to thirty mph over speed limit)

9.5 Ten Points

Three preventable collisions in a year
Fleeing or evading police and related offenses
Speeding (thirty-one to forty mph over speed limit)
Driver's license suspension
DWI/DUI and other alcohol-use violations
Driving while license is suspended
Hit-and-run violations
False reports
Reckless driving

9.6 Twenty Points

Four preventable collisions in a year
Any misdemeanor or felony charge except DUI/DWI
Speeding (forty-one or more mph over speed limit)

10.0 Driver's License Requirements

Drivers who fall under the scope of the DMV Policy must, at all times, possess a valid driver's license issued by the authority that has jurisdiction where the driver resides. The license class must be appropriate for the class of vehicle the person drives for (Organization Name).

11.0 Vehicle-Law Compliance

Persons who fall under the scope of the DMV Policy must, at all times, comply with all traffic laws that pertain to the area where they are driving.

12.0 Spouse Use of (Organization Name) Vehicles

The spouse or domestic partner of an (Organization Name) employee may operate a vehicle that has been assigned to that employee. This policy pertains to (Organization Name)-owned or -leased vehicles and does not include vehicles that bear (Organization Name) decals.

13.0 Reporting Violations

Drivers who fall under the scope of the DMV Policy must report to their immediate manager when they are charged with motor-vehicle violations as follows:

- Within 72 hours of their first reporting workday, they must report any moving violations they have been charged with.
- They must immediately report any suspension of driving privileges.
- Within 24 hours of their first reporting workday, they must report any serious motor-vehicle infraction as defined by this policy.

Any violation that affects a person's driver's license status affects the person's ability to legally operate a vehicle for (Organization Name). Therefore, reporting of violations includes violations that occur during either company or personal time and includes incidents that involve either company or personal vehicles.

13.1 Managers' Responsibility

Managers who receive a self-reported notification of a violation from an employee will, as soon as possible, report this information to the (Organization Name) Fleet Services and/or Risk Management Department.

14.0 Motor-Vehicle Collision Reporting

Persons who are involved in motor-vehicle collisions while operating any vehicle on (Organization Name) business or at any time while operating an (Organization Name)-owned or -leased vehicle must immediately report the collision to the (Organization Name) Fleet Services Department or its designee.

15.0 Seatbelt Usage

Drivers and passengers traveling in vehicles that are being driven on (Organization Name) business or in vehicles owned or leased by (Organization Name) must properly wear seatbelts while vehicles are in operation.

16.0 Vehicle Maintenance

Vehicles that fall under the scope of the DMV PolicyÁmust be properly maintained as described by the (Organization Name) Fleet Services Department.

17.0 Privately Owned Vehicles Used for Business

Persons who, with the approval of (Organization Name), use a privately owned vehicle for (Organization Name) business will receive a predetermined per-mile reimbursement for this use.

18.0 Collision Classifications

It is the responsibility of the (Organization Name) Fleet Services Department or its designee to determine whether an (Organization Name)-related motor-vehicle collision was preventable or nonpreventable as defined under sections 3.5 and 3.6 of the DMV Policy.

19.0 Driver Deductibles

19.1 If, within a three-year period, an employee is involved in a preventable collision while operating an (Organization Name) vehicle or while driving on (Organization Name) business, that employee will be charged a deductible fee of ???. [The fee is determined by individual organizations and typically increases with each offense.]

19.2 If, within a three-year period, an employee is involved in two preventable collisions while operating an (Organization Name) vehicle or while driving on (Organization Name) business, that employee will be charged a deductible fee of ???. [The fee is determined by individual organizations and typically increases with each offense.]

19.3 If, within a three-year period, an employee is involved in three preventable collisions while operating an (Organization Name) vehicle or while driving on (Organization Name) business, that employee will be charged a deductible fee of ???. [The fee is determined by individual organizations and typically increases with each offense.]

19.4 If, within a three-year period, an employee is involved in more than three preventable collisions while operating an (Organization Name) vehicle or while driving on (Organization Name) business, that employee will be charged a deductible fee of ??? and will face possible termination. [The fee is determined by individual organizations and typically increases with each offense.]

Commercial Vehicles

Department of Transportation (DOT) Regulations

The regulations covering commercial vehicles are extensive. Areas covered in these regulations include, but are not limited to, driver licensing; hours of service; weight, height, and length restrictions; vehicle inspection; and driver alcohol and drug violations.

For the purposes of this chapter, the focus will be on hours of service, alcohol and drug regulations, and driver licensing requirements.

Visit the Federal Motor Carrier Safety Administration (FMCSA) Web site at www.fmcsa.dot.gov for a complete view of commercial vehicle regulations.

Figure 2 is an excerpt of the Commercial Motor Vehicle Safety Act of 1986; it is taken from the Federal Motor Carrier Safety Administration Web site (FMCSA 2008).

CDLIS Clearinghouse

States must be connected to the Commercial Driver's License Information System (CDLIS) and the National Driver Register (NDR) in order to exchange information about CMV drivers, traffic convictions, and disqualifications. A state must use both the CDLIS and NDR to check a driver's record, and the CDLIS to make certain that the applicant does not already have a CDL. Members

COMMERCIAL MOTOR VEHICLE (CMV) SAFETY ACT OF 1986

The Commercial Motor Vehicle Safety Act of 1986 was signed into law on October 27, 1986. The goal of the Act is to improve highway safety by ensuring that drivers of large trucks and buses are qualified to operate those vehicles and to remove unsafe and unqualified drivers from the highways. The Act retained the State's right to issue a driver's license, but established minimum national standards which States must meet when issuing CDLs.

The Act addresses circumstances that existed prior to 1986 by making it illegal for CDL holders to possess more than one license, requiring States to adopt knowledge and skills testing to ensure that individuals required to have a CDL are qualified to operate heavy trucks and buses, and establishing minimum licensing standards and information requirements for the CDLs.

It is important to note that the Act does not require drivers to obtain a separate Federal license; it merely requires States to upgrade their existing testing and licensing programs, if necessary, to conform to the Federal minimum standards.

The CDL program places requirements on the CMV driver, the employing motor carrier and the States.

THE DRIVER

Drivers have been required to have a CDL in order to drive certain CMVs since April 1, 1992.

The Federal Motor Carrier Safety Administration (FMCSA) has developed and issued standards for testing and licensing CDL holders. These standards require States to issue CDLs to certain CMV drivers only after the driver passes knowledge and skills tests administered by the State and related to the type of vehicle the driver expects to operate. Drivers are expected to obtain and hold a CDL if they operate in interstate, intrastate, or foreign commerce if they drive a vehicle that meets any of the classifications of a CDL:

Classes of License:

The Federal standard requires States to issue a CDL to drivers according to the following license classifications:

Class A – Any combination of vehicles with a gross vehicle weight rating, GVWR, of 26,001 or more pounds provided the GVWR of the vehicle(s) being towed is in excess of 10,000 pounds.

Class B – Any single vehicle with a GVWR of 26,001 or more pounds, or any such vehicle towing a vehicle not in excess of 10,000 pounds GVWR.

Class C – Any single vehicle, or combination of vehicles, that does not meet the definition of Class A or Class B, but is either designed to transport 16 or more passengers, including the driver, or is transporting material designated as hazardous under 49 U.S.C. 5103 and is required to be placarded under subpart F of 49 CFR Part 172 or is transporting any quantity of a material listed as a select agent or toxin in 42 CFR Part 73.

Endorsements and Restrictions:

Drivers who operate special types of CMVs also need to pass additional tests to obtain any of the following endorsements on their CDL:

- T - Double/Triple Trailers (Knowledge test only)
- P - Passenger (Knowledge and Skills Tests)
- N - Tank Vehicle (Knowledge Test only)
- H - Hazardous Materials (Knowledge Test and TSA Threat Assessment)
- X - Combination of Tank Vehicle and Hazardous Materials
- School Bus (Knowledge and Skills Tests)

If a driver either fails the air brake component of the general knowledge test or performs the skills test in a vehicle not equipped with air brakes, the driver is issued an air brake restriction, restricting the driver from operating a CMV equipped with air brakes.

THE STATES

Knowledge & Skills Tests:

States develop their own tests, which must meet the Federal standards provided for in Subpart G and H of 49 CFR Part 383. Model driver and examiner manuals and tests have been prepared and distributed to the States to use, if they wish.

- Each basic knowledge test, i.e., the test covering the areas referred to in 49 CFR 383.11 for the applicable vehicle group, shall contain at least 30 items, exclusive to the number of items testing air brake knowledge.
- To pass the knowledge tests (general and endorsement), applicants must correctly answer at least 80 percent of the questions.
- To pass the skills test, applicants must successfully perform all the required skills (listed in 49 CFR 383.113 through 49 CFR 383.123). The skills test must be taken in a vehicle representative of the type of vehicle that the applicant operates or expects to operate.

Third-Party Skills Testing:

A State may authorize a person (including another State, an employer, a private driver training facility or other private institution, or a department, agency, or instrumentality) to administer the skills tests, if the following conditions are met:

- Tests must be the same as those given by the State.
- Examiners must meet the same qualifications as State examiners.
- The third party has an agreement with the State containing, at a minimum, provisions that:
  - States must conduct an on-site inspection at least yearly.
  - At least annually, State employees must evaluate the programs by taking third party tests as if they were test applicants, or by testing a sample of drivers tested by the third party and then comparing pass/fail rates.
- The State's agreement with the third-party skills tester must allow the FHWA and the State to conduct random examinations, inspections, and audits without prior notice.

FIGURE 2. Excerpt from Commercial Motor Vehicle Safety Act of 1986

Exemption of Skills Testing Requirements:

States have the option to exempt certain individuals with good driving records from the skills testing requirements (commonly known as "grandfathering"). The State shall impose conditions and limitations to restrict the applicants from whom a State may accept alternative requirements for the skills test described in 49 CFR 383.11. Such conditions must require at least the following:

Driver has a current license at time of application; and Driver has a good driving record and previously passed an acceptable skills test; or driver has a good driving record in combination with certain driving experience.

"Good driving record" means:

A driver can certify that, during the 2-year period immediately prior to applying for a CDL he/she:

- Has not had more than one license;
- Has not had any license suspended, revoked, or canceled;
- Has not had any convictions in any type of motor vehicle for major disqualifying offense;
- Has not had more than one conviction for any type of motor vehicle for a serious traffic violation;
- Has not had any violation of State or local law relating to motor vehicle traffic control arising in connection with any traffic accident, and has no record of an accident in which he/she was at fault.

"Driving experience" means:

A driver can certify and provide evidence that:

- He/she is regularly employed in a job requiring operation of CMV, and that either:
- He/she has previously taken and passed a skills test given by a State with a classified testing system, and that the test was behind-the-wheel in a representative vehicle for that applicant's driver's license application; or
- He/she has operated a representative vehicle for at least 2 years immediately preceding application for a CDL.

Commercial Driver's License Document:

A State determines the license fee, the license renewal cycle, most renewal procedures, and continues to decide the age, medical and other driver qualifications of its intrastate commercial drivers. Interstate drivers must meet the longstanding Federal driver qualifications (49 CFR 391).

All CDLs must contain the following information:

- The words "Commercial Driver's License" or "CDL";
- The driver's full name, signature, and address;
- The driver's date of birth, sex, and height
- Color photograph or digitized image of the driver;
- The driver's State license number;
- The name of the issuing State;
- The date of issuance and the date of the expiration of the license;
- The class(es) of vehicle that the driver is authorized to drive;
- Notation of the "air brake" restriction, if issued;
- The endorsement(s) for which the driver has qualified.

States may issue learner's permits for purposes of behind-the-wheel training on public highways as long as learner's permit holders are required to be accompanied by someone with a valid CDL appropriate for that vehicle and the learner's permits are issued for limited time periods.

Waiver Provisions:

All active duty military drivers were waived from the CDL requirements by the Federal Highway Administrator. A State, at its discretion, may waive firefighters, emergency response vehicle drivers, farmers and drivers removing snow and ice in small communities from the CDL requirements, subject to certain conditions.

In addition, a State may also waive the CDL knowledge and skills testing requirements for seasonal drivers in farm-related service industries and may waive certain knowledge and skills testing requirements for drivers in remote areas of Alaska. The drivers are issued restricted CDLs. A State can also waive the CDL hazardous materials endorsement test requirements for part-time drivers working for the pyrotechnics industry, subject to certain conditions.

OTHER REQUIREMENTS

There are a variety of other requirements related to this legislation which affect the commercial drivers, their employing motor carriers and the States.

Penalties:

The Federal penalty to a driver who violates the CDL requirements is a civil penalty of up to $2,500 or, in aggravated cases, criminal penalties of up to $5,000 in fines and/or up to 90 days in prison. An employer is also subject to a penalty of up to $10,000, if he or she knowingly uses a driver to operate a CMV without a valid CDL.

CDLIS Clearinghouse:

States must be connected to the Commercial Driver's License Information System (CDLIS) and the National Driver Register (NDR) in order to exchange information about CMV drivers, traffic convictions, and disqualifications. A State must use both the CDLIS and NDR to check a driver's record, and the CDLIS to make certain that the applicant does not already have a CDL. Members of the law enforcement community seeking access to CDLIS data should visit the FMCSA Technical Support Web site. Carriers needing CDLIS data should seek a commercial company that provides a clearinghouse service for this information, or contact the driver's State of licensure.

FIGURE 2. Excerpt from Commercial Motor Vehicle Safety Act of 1986 (cont.)

of the law-enforcement community seeking access to CDLIS data should visit the FMCSA Technical Support Web site. Carriers needing CDLIS data should seek a commercial company that provides a clearinghouse service for this information, or contact the driver's state of licensure.

Hours of Service Regulations

The rules governing hours of service were changed in 2005. The last changes had been made in 2003. Figure 3 offers a snapshot of the new regulations.

Short-Haul Hours-of-Service Provisions

Short-haul drivers are drivers of property-carrying CMVs who do not require a commercial driver's license for operation and who operate within a 150 air-mile radius of their normal work-reporting location. They

- may drive a maximum of ten hours after coming on duty following ten or more hours off duty
- are not required to keep records of duty status (RODS)
- may not drive after the fourteenth hour after coming on duty five days a week, or after the sixteenth hour after two days a week

In place of RODS, these employers must maintain and retain accurate time records for six months that show what time duty periods began and ended and the total hours on duty each day.

Drivers who use this short-haul provision are not eligible to use the 100 air-mile provision (395.1(e)) or the current sixteen-hour exception in 395.1(o).

2003 Rule Property-Carrying CMV Drivers (compliance through 09/30/05)	2005 Rule Property-Carrying CMV Drivers (compliance on and after 10/01/05)
May drive a maximum of eleven hours after ten consecutive hours off duty	No change
May not drive beyond the fourteenth hour after coming on duty following ten consecutive hours off duty	No change
May not drive after 60/70 hours on duty in a seven/eight-consecutive-day period after taking 34 or more consecutive hours off duty	No change
CMV drivers using a sleeper berth must take ten hours off duty, but may split sleeper berth time into two periods provided neither is less than two hours.	CMV drivers using the sleeper berth provision must take at least eight consecutive hours in the sleeper berth or off duty or any combination of the two.

Passenger-carrying carriers/drivers are not subject to the new hours-of-service rules. These operators must continue to comply with the hours-of-service limitations specified in 49 CFR 395.5.

FIGURE 3. Hours-of-service regulations (*Source:* FMCSA 2005)

Result:	Action:
Less than 0.02%	No action required under CFR Part 40
0.02%–0.039%	Varies among DOT agencies. For example, FMCSA states that a driver may not resume safety-sensitive functions for twenty-four hours (382.505), while the Federal Railroad Administration (FRA) requires eight hours (219) .101 (a)(4). The Federal Transit Administration (FTA) and Pipeline and Hazardous Materials Safety Administration (PHMSA) require only that a driver test below 0.02%. A driver who does not pass that test cannot work until the next scheduled duty period, which cannot be less than eight hours from the time of the test (655.35 and 199.237 respectively).
0.04% or greater	Drivers must immediately be removed from safety-sensitive functions and may not resume them until they successfully complete the return-to-duty process.

FIGURE 4. BAC finding and subsequent actions

Drug and Alcohol Regulations for CDL Drivers

The laws regulating the use of drugs and alcohol are much more stringent for CDL drivers than for drivers with standard licenses. Preemployment testing, testing on the job, and lower blood-alcohol-concentration allowances are a few examples of these stricter provisions. The regulations are extensive and complicated. To obtain the full text of these regulations, visit this section of the FMCSA Web site: (www.fmcsa.dot.gov/safety-security/safety-initiatives/drugs/drug-guidelines.htm).

Figure 4 provides an overview of the laws regarding blood-alcohol-concentration (BAC) limitations for CDL drivers.

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Recommended Resources

There is a growing awareness in the once-forgotten area of driver safety. Because of this, numerous organizations, both private and government, provide information that can help with driver safety programs. The sources below provide a wealth of information.

Traffic Accident Reconstruction Origin (TARO). www.tarorigin.com
Transit Cooperative Research Program, www.trcponline.org
Transportation Research Board (TRB). www.trb.org
U.S. Bureau of Labor Statistics, U.S. Department of Labor. www.bls.gov
U.S. Department of Transportation (US DOT). www.DOT.gov

Additional Reading

How Perdue Farms Inc. Implemented A Video-Based Driver Risk Management Program*

Del Lisk
Vice President, Safety Services
DriveCam

Frank Cruice
Senior Director, Corporate Safety & Security
Perdue Farms

Tommy Pollard
Corporate Fleet Safety Manager
Perdue Farms

Introduction

Perdue Farms faced increasing driving accidents at one particular facility, resulting in an increase in vehicle accident costs and negative safety behaviors. The company investigated various options to improve driver safety and evaluated a video-based driver risk management system at that facility, which eventually spread to the entire fleet. This paper will illustrate how Perdue navigated throughout their organization to implement a process that improved driver safety behaviors and results. In this paper, we will:

- Learn about new safety technologies and how to evaluate them
- Understand how a video-based driver risk management system improves driver behavior and reduces claims costs
- Learn how to navigate throughout an organization to implement a new program – from executive management (C-level) to drivers, including Risk, Human Resources, Safety and Transportation/ Logistics

First, we begin with a look at the solution that Perdue adopted and some of the data already gathered about driver risk management.

The Solution

DriveCam customers deploy in-cab video technology and objective third-party analysis as a means to improve driving, as well as capture the truth if a collision occurs. The video camera is commonly affixed to the windshield and is loop recording in front, as well as inside, the vehicle. When the vehicle experiences substantial force, such as hard braking or swerving, the device is triggered to save the 8 seconds before the moment of force as well as an additional 4 seconds afterward. The net result is a video that reveals what happened and why. This video is then uploaded to a review center, where it is objectively reviewed and assessed for risk. Events with a significant level of concern are then directed to the client for driver coaching via a web platform. Exhibit 1 illustrates this process.

Exhibit 1. Process of Review of Risky Driving Behavior

DriveCam has analyzed approximately 30 million risky driving clips, and has learned a tremendous amount about driver behavior and what can be done to make drivers safer and more fuel efficient.

Armed with the ability to isolate and correct risky driving before it leads to a crash, clients report tremendous improvements in fleet safety as well now having the ability to protect themselves and their drivers against false claims:

- Heritage Propane reduced collisions by more than 60%
- Orange County, Florida, reduced cost of accidents by 81% in the first year
- Amerigas reduced the number of risky driving incidents by almost 60%
- Mactec reduced collisions by 75%
- TXI reduced accidents by almost 50%

As with any impactful safety process, there are challenges. Discussed below are the most common challenges:

Getting the Funding

Budgets are generally tight so getting funding can be a challenge. Organizations are demanding that all investments—including investments in safety—must have a measurable positive financial impact for the organization. It's important that the returns on investment expectations are presented internally to the decision-makers. This is a simple process of taking historical costs of traffic accidents and showing what the impact of reducing costs by 30-50% would be. In many cases, the program has paid for itself in one year or less. Lloyd Pest Control, a California-based pest control service with 300 vehicles, reports the program paid for itself in the first 90 days.

Often, there are concerns internally from the legal department. The concern is, "What if a serious accident happened and the video showed it was our fault? How would the video impact an award if this went to trial?" Every one of our clients has considered this and decided the positives far outweigh this concern. The positives that need to be factored in are:

- Reduced collisions—the best way to reduce the cost of an accident is to prevent it altogether
- Ability to more effectively defend against false claims
- Even if at fault, with the video, clients quickly know the facts and can move immediately to a quick settlement. Sometimes they can settle before the other party gets a lawyer involved.

- Far less investigative costs. The video shows what really happened, so the need for an accident reconstructionist, investigators or others to assist with the case is greatly reduced.

Impacts on Operations

Organizations are running lean and mean. There are scant resources to dedicate to managing new processes. Consequently, it is essential that a process such as this does not put too many demands on management. DriveCam long ago recognized this and designed tools that make it easy for management to quickly identify what the issues are and what needs to be done. Also, most of the heavy lifting occurs in the first few weeks when driver coaching begins. This workload drops dramatically as drivers quickly improve and there are far fewer risky driving incidents to require coaching. It is common for clients to see risky events and the subsequent workload drop by 50 percent just one month after program launch.

Some companies wonder if their culture meshes with a solution like this. It's a good question. Looking at the vast array of cultures within our 500+ clients, we've come to realize this is the wrong question to ask. Instead, the question should be, "can this solution be adapted so it meshes with our company culture?" Our clients adjust the program in many ways to align with their culture –

- Some only coach, others tie in discipline when errors are more serious
- Some have drivers "self-coach"
- Some work closely with labor to review and adjust the program on an on-going basis
- Some tie in manager bonuses to risk reduction
- Some leave expectations and oversight at the local level; others design corporate oversight that cascades down through the organization

Another common concern or challenge is how a program such as this will be received by labor. If the driver force is unionized, this concern is usually higher. The key is to have open, early communication with union leaders and employees long before equipment is installed in vehicles. We find there is more push back from labor when early communication did not occur.

Most of the concerns are due to misconception, misinformation or lack of experience with the program and relate to two issues:

1. *The technology*: Drivers mistakenly think the technology has the ability to record everything, all the time, or that management can trigger it remotely to record or look in live. It doesn't have these capabilities. An event is only triggered when a vehicle experiences unusual force or is excessively speeding.
2. *The video will be used against them:* It's important to emphasize that the intent of the program is to improve driving behavior through coaching and training. Statistics prove that drivers do become safer with this solution. Safer drivers have fewer accidents than drivers who are having problems, and therefore their jobs are more secure, not less. It's also important to recognize that video may protect the driver in an incident that may otherwise been blamed on him/her.

The Perdue Farms Story

Perdue Farms is the third largest producer of poultry food products in the U.S. The Perdue Family of Companies includes Perdue Farms, Perdue AgriBusiness, and shared services organizations. Since its beginning on Arthur Perdue's farm in 1920, through expansion into agribusiness and the introduction of the PERDUE® brand of chicken and turkey under Frank Perdue, to today's third-generation of family leadership with Chairman Jim Perdue, the company has remained a family-owned entity dedicated to making Perdue the most trusted name in food and agricultural products.

Dedicated equally to the safety of its associates as to its product, Perdue recognized a need to improve upon its fleet safety process in order to decrease associate injuries, and reduce operational costs from crashes that were negatively impacting the bottom line. In order to leverage current staffing while allowing that staff to become more effective, Perdue sought to develop a fleet-driven, behavioral based safety (BBS) process. The company was looking to leverage a technology solution to help achieve those objectives.

As with most companies, staff was already stretched. "We were stretched for people, time and resources, and with a mixed fleet of 1,200 commercial and non-commercial vehicles, we knew the only way we would be able to make an impact with our drivers and improve driver behavior without adding staff would be to leverage technology," said Frank Cruice, senior director corporate safety and security for Perdue.

Perdue had employed driving simulators in the past and has strategically installed various vehicle-based safety systems, such as lane departure warning systems, on-board diagnostics, blind-side sensing systems, and front-facing radar. These tools were valuable, but ultimately

Perdue decided to implement a driver risk management solution at two sites where risky driving incidents were highest, in an effort to truly change driver behaviors.

Now that a need had been established for a Driver Risk Management solution, both Frank Cruice and Tommy Pollard, corporate fleet safety manager at Perdue, conducted an assessment of available service providers. Once service providers were sourced, they conducted vendor presentations to the implementing staff in order for them to take ownership in the decision as to what product/vendor they felt could deliver and provide the most value for their investment. Ownership by a site in selecting a service provider is paramount to ensuring a successful beta test within your organization. Based on the presentation and capability of its global driver risk management system, DriveCam was selected to implement their technology solution within Perdue's pilot fleet of 37 commercial vehicles dispersed within three separate types of short haul operations.

DriveCam combines audio and video event capture with expert analysis and driver coaching to identify and correct risky driving behavior before a collision occurs. DriveCam's palm-sized, exception-based video event recorder is mounted in vehicles behind the rearview mirror and captures sights and sounds inside and outside the vehicle. Exceptional forces trigger the video event recorder to save critical seconds immediately before and after the triggering event. Saved events are downloaded, reviewed, assigned a risk score and used to coach drivers to operate more safely. DriveCam's driver risk management solution has helped more than 1,500 fleets reduce vehicle damages, workers' compensation, personal injury and claims cost by as much as 50 percent in nearly 100,000 vehicles.

Pollard knew nothing could compare to the power of sight and sound when reviewing an incident and determining the root cause of a collision or risky driving event. "Nothing affords us the data and insight that video does," said Pollard. "As we evaluated alternative solutions, it became very clear that DriveCam gave us the best data to get into the dugout with the driver and change that behavior for the better. How can you beat video? As the adage goes, a picture is worth 1,000 words... especially when that picture happens to be video."

Cruice secured approval from senior management to test the DriveCam solution at the pilot sites that were experiencing a higher than usual number of risky driving incidents. Perdue deployed the solution in three different types of vehicles: hatchery, dry bulk feed and live haul trucks. Prior to deployment, Pollard brought the solution to the site managers and the drivers themselves. He introduced DriveCam and discussed the benefits of the solution for each driver, allaying any concerns and misperceptions they might have had. Pollard shared video clips with the drivers and discussed the benefit of incident exoneration. Local managers would be responsible for reviewing video from the DriveCam Risky Driving Analysts, and then coaching drivers accordingly. They supported the program and were instrumental in the selection process because they felt a sense of ownership and involvement from the outset. This also helped impact overall driver acceptance.

Perdue saw a distinct reduction in the number of incidents incurred among fleets outfitted with the DriveCam solution. The company experienced an 88 percent reduction in vehicle incidents compared to the previous year without DriveCam. Additionally, the first collision that occurred following implementation of the DriveCam solution was one in which the video evidence exonerated the driver. This immediately justified the need for the solution in the Perdue fleet.

By implementing the DriveCam solution, Pollard feels that drivers have the much-needed reminder to make conscious decisions while driving, as if he was in the vehicle with them.

"How do you be there without really being there?" Pollard asks. "Our commercial drivers are out there alone, but DriveCam helps them make conscious decisions about their driving because they know the event recorder is there."

The data gathered from each recorder is used to decide where to focus training time, and has helped Pollard determine why incidents are occurring.

Pollard reports that drivers have been receptive to the coaching and appreciate the evidence exonerating them and helping them maintain their safety records. In the case of Perdue's short-haul fleet, often the roads that drivers travel are winding with little to no shoulder or room for error. As these particular vehicles often travel at night, Perdue relies on its drivers to be alert and aware, to keep both themselves and their vehicles safe. Implementing the DriveCam solution allowed Perdue to identify the riskiest behaviors seen on these types of roads and coach drivers to safely operate their vehicles.

Initially, Perdue recognized that one of their largest motor vehicle losses came from single vehicle accidents classified as "run off road and rollover." Nearly 1/3 of these types of accidents were stemming from the selected project site. The DriveCam solution validated that the root cause of these incidents was driver distraction. This evidence showed the company what the leading indicators were and, consequently, Perdue was able to strategize a Crash Reduction Plan based on facts. Pollard says,

"In the past, we spent over 80 percent of our time on investigating and debating what happened, and now with the naturalistic data that the camera produces, we spend less than 20 percent of the time on that. Most all of our time is spent on preventing reoccurrence. The camera inverts this equation and puts the emphasis on preventing reoccurrence versus trying to figure out why!"

"Bottom line is, the DriveCam solution gives us the feedback as to why, and provides the data to help us understand what's going on and where to focus our efforts," said Pollard.

While reviewing incidents for coaching, Perdue began to revise other areas of its safety policies, including seat belt and cell phone usage. The camera evidence allowed Perdue to take direct action under its driver policies for these types of violations and turn their focus towards changing driver behavior through a behavioral management approach versus a "discipline" approach. Using the DriveCam solution, Perdue managers monitor severity and repeat behaviors. When a driver reaches a predetermined level, managers step in and develop a performance improvement plan, or PIP, for that driver instead of punitive measures and disciplines. This reinforces the process by showing the driver the company is not just looking to discipline, but rather to create a culture of safety and driver improvement.

"The DriveCam solution became a hub for the driver safety process," said Pollard. "It brought all entities—drivers, managers and senior management—to the same table, allowing us to review our safety processes comprehensively and identify the areas in need of attention."

Through the use of this technology, Perdue continues to embed a culture of safe driving behavior within its company. They have begun a journey to level the playing field between the drivers and managers by instituting a parallel using defensive driving education as the coaching platform for managers. When managers see the videos and in turn coach their drivers, they use defensive driving as the primary communication. Pollard says, "It's not about right or wrong, it's about, did we have an opportunity to drive defensively to prevent the incident?" Using the defensive driving platform during coaching also puts the manager and driver on the same level. Pollard says that whether you are driving a scooter, car, SUV or the big truck, defensive driving is still defensive driving. "Yes, stopping distances may vary between the big truck and car but following distance is the coaching moment," said Pollard. Using the data from the DriveCam solution and the defensive driving platform, the focus turns away from the big truck and onto following distance. Thus, both manager and driver are on equal footing. The bottom line is that you don't have to have big-truck experience to coach big-truck drivers.

Summary

Driver safety efforts tend to go through periods where one issue reaches a critical mass in awareness and goes viral. This is a positive phenomenon in that it draws many different stakeholders into the issue and causes changes to happen more quickly than they may otherwise have. But it can also lull fleet operators into thinking they've solved the problem. Some may overlook other crucial safety issues and will later be disappointed when the results they were expecting don't follow.

Until the day when technology takes driving decisions out of the hands of the operator, a key focus of safety efforts needs to be on insuring drivers are using the fundamental safe driving skills that have separated the "good driver" from the "bad driver" since the invention of the automobile. Vehicles and technology have changed dramatically over the years, but the underlying causes for people making mistakes behind the wheel have not.

In the case of Perdue Farms, it was one specific facility where critical mass got the attention of fleet safety, which led to a technology solution deployment at that facility, and ultimately to fleet-wide deployment. ***Perdue measured an ROI of 406% after the first two years and an 88 percent reduction in vehicle incidents compared to the previous year without DriveCam.*** *Frequency and severity were measured for the three (3) years prior and after implementation and returned extremely favorable results.* Best seen in the chart below, Perdue measured the longevity of the process and experienced fewer accidents and less cost because driving behaviors were addressed. The frequency was reduced by 60 percent, and severity was reduced by 86 percent.

- Frequency at three (3) years prior to implementation of DriveCam averaged 15.3 incidents/year; (vs.) three (3) year post implementation averaged 6.3 incidents/year.
- The project site had been averaging $420,716 in accident costs for the three prior fiscal years. Since implementation, vehicle accident costs have been reduced to an average of $59,671 per year.

History

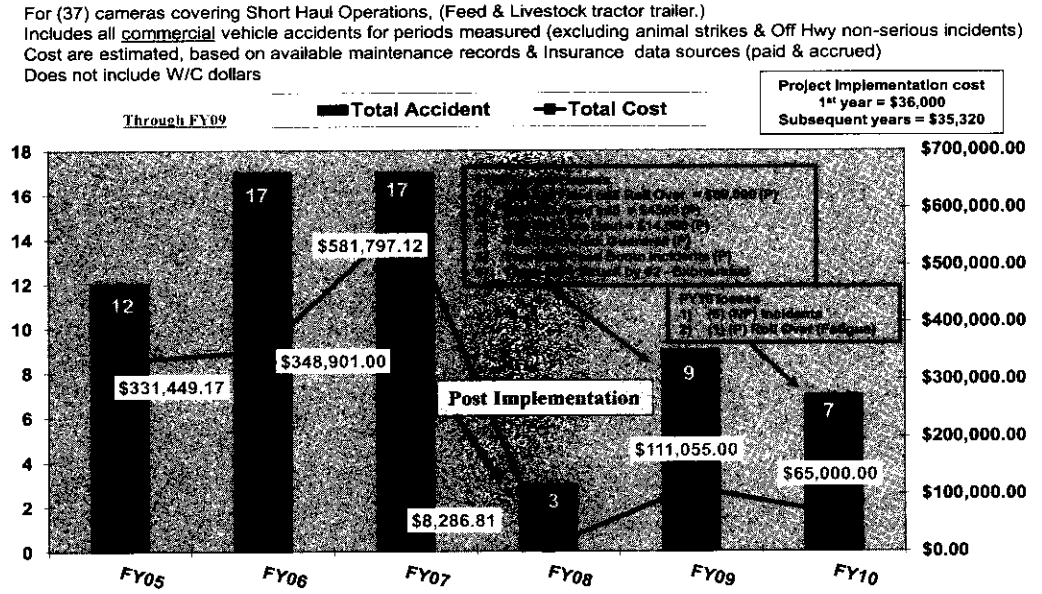

Exhibit 2. Truck Mounted Camera Pilot Project: Total Accident & Total Cost Before/After Implementation

As an advocate for safety across the company, Cruice is always looking for a new process to maintain Perdue's high standard of safety. He believes the DriveCam solution supports and enhances the company's existing process.

"At Perdue, we measure the four P's – People, Products, Profitability and Planet," said Cruice. "DriveCam is an integral part of our corporate behavioral-based safety process, and is used to constantly to monitor, coach and improve our driver's behaviors. Thus keeping Perdue a company deeply engaged in employee safety that always puts its associates—and those we share the roads with—first."

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