HazMat Decontamination
A Weak Link in Emergency Response
Fleet Safety
Guidance From ANSI/ASSE Z15

Leading Thoughts
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-Steve Jobs

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HazMat Emergencies
Decontamination & Victim Chain of Survival
By Scott Gunderson, Cameron Helikson & Michael Heffner

HazMat emergencies represent a significant response challenge, especially when employees are exposed and the response involves a victim. A growing body of literature and standards guides emergency medical services (EMS) and hospital professionals in HazMat victim response and treatment. But, the SH&E professional must navigate separate standards: HazWOPER for HazMat emergencies and standard first aid for HazMat victim response. What strengths each standard may have in isolation are lacking when coupled with each other or as explicit preparation for the more advanced response that follows when EMS arrives. The authors review these standards and integrate several key concepts for effective response to HazMat victim emergencies in the workplace to make the most of the critical time between employee exposure and EMS arrival.

Fleet Safety
Developing & Sustaining an Effective Program With ANSI/ASSE Z15.1
By Brian S. Hammer, Stephanie G. Pratt and Peggy Ross

The risk of work-related motor vehicle crashes 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 vehicle crashes while driving or riding in a motor vehicle on a public roadway. This article discusses how ANSI/ASSE Z15.1-2012 provides comprehensive guidance on fleet safety program elements and can be used as a foundation for auditing an existing program.

Roof Instability
What Reportable Noninjury Roof Falls in Underground Coal Mines Can Tell Us
By T.S. Bajpayee, Deno M. Pappas and John L. Ellenberger

Roof falls are a major hazard in underground mining. Roof bolting is the primary means of supporting the mine roof in underground coal mines. Despite great strides in the design of support systems, roof falls continue to occur in bolted areas. Noninjury roof fall reports provide insight into the characteristics of roof falls. This study examined 11,600 noninjury roof fall reports to identify geological contributors to roof falls. The goal is to provide data that can help improve roof-fall-related safety by providing direction for the research and development of improved support systems and mine layout alternatives.
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By the Numbers
For a more specialized member experience, ASSE offers many practice specialties, branches and common interest groups. Within these groups, members have opportunities to network, share knowledge and become published authors. Here’s some quick information:

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- **4** Branches
- **4** Common interest groups
- **3** Technical publications/year for each group

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Looking for a previously published feature article? Visit Professional Safety’s Article Archive & Reprints website at www.asse.org/professionalsafety/archive.php. The site provides the necessary links to find what you might be looking for. Here are some tips to get your search started:

- Access PS Online to search for articles by keyword, date and/or author. This database will retrieve articles from January 2000 to present. Members can log in to download articles for free.
- Log in to the ASSE Members Only portal to view full-issue PDFs (2005 to 2008); full-issue online archives (2009 to 2011); and full-issue digital editions (2012 to current).
- Access the Article Index website to search for an article title, author name or subject by year (1995 to 2011).

Honor Roll Is Online
See who is sharing the benefits of ASSE membership with their colleagues. Find the latest list of top recruiters at www.asse.org/member-ship/honorroll.php.

Three Free Podcasts: Virtual Classroom Exclusives

**Leading an Ergonomic Culture to Achieve Multiple Returns**
Soft-tissue and other wear-down injuries can seriously affect a workforce, especially one that is aging. Traditional approaches have shown limited results that can create a performance plateau. In this podcast, Robert Pater provides proven, efficient approaches for accomplishing several objectives: build a critical mass of workers directing attention; and adjust to small changes that build toward enhancing safety and overall performance.

**Industrial Electrical Safety Inspections**
Effective management of worker safety and health protection helps reduce the extent and severity of work-related injuries. Electrical safety inspections must be conducted to verify full compliance with OSHA and NFPA electrical safety regulations and standards. This podcast provides guidelines to develop an inspection program.

**Effective Confined-Space Entry Team Member Training**
This podcast discusses training techniques to ensure that confined-space-entry team members receive comprehensive training that will allow safe entry, work and exit from a confined space. Additional topics include hazard evaluation, proper equipment usage, and when and how to activate a rescue plan.

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While in the Newark airport recently, I noticed a businesswoman carrying a bag emblazoned with this quote: “The future is unwritten.” Attributed to Joe Strummer, front man of the band The Clash, these words inspired me to think about ASSE and our unwritten future. Opportunities abound for ASSE, the safety profession and safety professionals, if we are bold enough to recognize and seize them. Let’s consider just a few of the ways that ASSE helps us collaborate to write a bright future.

Creating the Road Map
Our profession is on the cusp of great change and ASSE is positioned to both inform and lead this change. Over the past 8 months, I’ve shared updates on the Society’s many strategic initiatives, from students and global outreach to promoting our profession’s business value and connecting safety to business goals and initiatives. In particular, ASSE’s collaborative partnership in the Center for Safety and Health Sustainability and our creation of the Risk Assessment Institute are key steps in our efforts to ensure that corporate leaders consider occupational safety when making business decisions.

The Society is also an active, influential voice in the collaborative global effort to frame the profession. By setting competencies for safety professionals, we will provide a benchmark, agreed to by global consensus, on the skills (technical and business) and the readiness needed for safety professionals to work effectively anywhere in the world. These diverse initiatives directly affect each of us as SH&E professionals practicing today, and they move our profession and ASSE toward the future.

Leading Culture Change
ASSE and our members are also at the forefront of efforts to develop an international standard for occupational safety and health management systems. ASSE is the administrator of the U.S. Technical Advisory Group (TAG) for ISO Project Committee 283, Occupational Health and Safety Management Systems—Requirements. More than 80 TAG stakeholders and thought leaders met in Washington, DC, to participate in the development of ISO 45001, a risk-based standard that will encompass leadership engagement, risk assessment and continual improvement. By fostering a systems-thinking approach to safety management, this standard has the potential to transform business culture and help elevate SH&E professionals and the profession worldwide.

This standards-development work ties directly to ASSE’s efforts to educate our stakeholders on the value of occupational safety, and to help SH&E professionals align occupational safety with business strategy, goals and planning. The culture transformation that occurs when safety professionals partner and collaborate to inform organizational strategy and influence operational decision making is both evolutionary and revolutionary. It takes business time to change its culture around workplace safety. Yet, when safety professionals step outside their comfort zone and engage executives by making a business case for safety, companies can experience operational excellence, high productivity, top quality, lower costs and continuous improvement. That can be revolutionary.

Connecting the Dots
While the future is unwritten, by focusing on assessing risks and seizing opportunities, developing a dynamic strategic plan and engaging key stakeholders in understanding the business value of occupational safety, we can take proactive steps to ensure that the future is a bright one for safety professionals, our profession and ASSE.

Opportunities abound for us to become valued business partners, contributors, in-demand collaborators and go-to resources for decision makers in our organizations. I wonder, What choices will you make today to seize these opportunities and help write our collective future?

“We are continually faced by great opportunities brilliantly disguised as insoluble problems.”

Lee Iacocca

President’s Message

Kathy A. Seabrook, CSP, CMIOSH, EurOSHM

Connect With Kathy

Join the conversation. Read Kathy’s blog, follow her on Twitter, or join her on LinkedIn or Facebook. www.asse.org/getconnected.
March 27 Seattle, WA

March 24-27 Orlando, FL
17th Annual Applied Ergonomics Conference. IIE; (800) 494-0460; www.iienet2.org/Endo/Conference.

March 24-28 Des Plaines, IL

March 25-27 Columbus, OH

March 25-28 San Diego, CA

March 25-27 Chicago, IL

March 25-28 Houston, TX

March 27 Syracuse, NY

March 27 Seattle, WA

March 27-28 Calgary, Alberta

March 27-28 Tampa, FL

March 27-28 Dallas, TX

March 27-28 Austin, TX

Lansing, MI
April 15-16 Michigan Safety Conference
Held each spring, this event features more than 120 workplace safety and health, and recertification courses. Attendees can interact with more than 200 exhibitors at the trade show, which will also feature new product demonstrations. The event will also feature a health and wellness center, silent auction and recognition awards. Michigan Safety Conference Headquarters; (517) 203-0737; www.michsafetyconference.org

March 28 Knoxville, TN
25th Annual ASSE East Tennessee Chapter PDC. Chris Jones, ASSE East Tennessee Chapter; chrisjones865@comcast.net.

March 28 League City, TX

April 1 Online
Certified HazMat Manager Exam Preparation workshop. Bowen EHS; (866) 264-5852; www BowenEHS.com.

April 1-3 San Diego, CA

April 2-4 Orlando, FL

April 2-3 Calgary, Alberta

April 2-3 Dallas, TX
HazWOPER 40-Hour General Site Worker course. ETC Compliance Solutions; (602) 923-9673; www.e-t-c.com.

April 2-3 Kansas City, MO
Emergency Dental Care course. EnPro Industries; (800) 336-1234; www.enprosafety.com.

April 2-3 Kansas City, MO

April 2-3 Phoenix, AZ

April 2-3 Columbus, OH

April 4-6 Washington, DC

April 4-6 New York, NY

April 7-8 Houston, TX

April 7-9 Crystal City, VA
Corporate Safety Management seminar. ASSE; (847) 699-2929; www.asse.org.

April 7-11 Kingston, TN

April 7-11 Phoenix, AZ
HazWOPER 40-Hour General Site Worker course. ETC Compliance Solutions; (602) 923-9673; www.e-t-c.com.

April 7-11 New York, NY

April 8-9 Cincinnati, OH
HAZWOPER 40-Hour General Site Worker course. ETC Compliance Solutions; (602) 923-9673; www.e-t-c.com.

April 8-9 Denver, CO

April 8-9 Cincinnati, OH

April 8-9 Houston, TX
<table>
<thead>
<tr>
<th>Event Date</th>
<th>Location</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>April 10</td>
<td>Phoenix, AZ</td>
<td>HazCom/GHS 8-Hour Train-the-Trainer course. ehs International Inc.; (949) 540-6800; <a href="http://www.ehsinternational.org">www.ehsinternational.org</a>.</td>
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<tr>
<td>April 10</td>
<td>Houston, TX</td>
<td>Advanced Cultural &amp; Behavior Tactics workshop. ProAct Safety; (800) 395-1347; <a href="http://www.proactsafety.com">www.proactsafety.com</a>.</td>
</tr>
<tr>
<td>April 10-11</td>
<td>Crystal City, VA</td>
<td>Delivering a High-Performance Safety Management System seminar. ASSE; (847) 699-2929; <a href="http://www.asse.org">www.asse.org</a>.</td>
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<tr>
<td>April 11</td>
<td>League City, TX</td>
<td>Competent Person Inspection Training for Frame, Tube &amp; Coupler &amp; System course. Scaffold Training Institute; (281) 332-1613; <a href="http://www.scaffoldtraining.com">www.scaffoldtraining.com</a>.</td>
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<tr>
<td>April 14</td>
<td>Chicago, IL</td>
<td>DOT HazMat course. Transportation Management Group Inc.; (866) 572-8644; <a href="http://www.tmgihazmat.com">www.tmgihazmat.com</a>.</td>
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<tr>
<td>April 14-18</td>
<td>Boston, MA</td>
<td>Radiation Safety Officer Training for Laboratory Professionals course. Harvard School of Public Health; (617) 384-8692; <a href="https://ecpe.sph.harvard.edu">https://ecpe.sph.harvard.edu</a>.</td>
</tr>
<tr>
<td>April 18</td>
<td>Online</td>
<td>Using Big Data to Predict, Prevent &amp; Eliminate Death on the Job webinar. Voluntary Protection Programs Participants’ Association; (703) 761-1146, ext. 500; <a href="http://www.vpppa.org">www.vpppa.org</a>.</td>
</tr>
<tr>
<td>April 18</td>
<td>Kirkland, WA</td>
<td>Basic First-Aid course. Evergreen Safety Council; (800) 521-0778; <a href="http://www.esc.org">www.esc.org</a>.</td>
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<tr>
<td>May 7-9</td>
<td>Honolulu, HI</td>
<td>13th Biennial Governor’s Pacific Rim Safety &amp; Health Conference This conference offers attendees an opportunity to learn, network and share best practices with peers. The event features more than 50 breakout sessions, six technical sessions and an array of exhibitors on hand to discuss their products and services. Keynote speakers include past ASSE presidents Skipper Kendrick and Rick Pollock, as well as fall protection expert Nigel Ellis. Other topics include professional issues; legal implications of Z15 on fleet operations; and safety at work, home and play. ASSE Hawaii Chapter; <a href="http://www.assehawaii.org/pacrim">www.assehawaii.org/pacrim</a></td>
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<tr>
<td>April 22-23</td>
<td>Midland, MI</td>
<td>Root-Cause Analyst Level 1: Facilitator course. Sologic; (800) 375-0414; <a href="http://www.sologic.com">www.sologic.com</a>.</td>
</tr>
<tr>
<td>April 23</td>
<td>Online</td>
<td>Real Programs &amp; Strategies That Ignite Employee Engagement webinar. ASSE; (847) 699-2929; <a href="http://www.asse.org/webinars">www.asse.org/webinars</a>.</td>
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<tr>
<td>April 29</td>
<td>Raleigh, NC</td>
<td>Combustible Dust Hazards seminar. Southeastern OSHA Training Institute Education Center; (800) 227-0264; <a href="http://www.ies.ncsu.edu/otieducationcenter">www.ies.ncsu.edu/otieducationcenter</a>.</td>
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<tr>
<td>April 30</td>
<td>Raleigh, NC</td>
<td>Advanced Topics in Office Ergonomics workshop. The Ergonomics Center of North Carolina; (800) 664-3746; <a href="http://www.theergonomicscenter.com">www.theergonomicscenter.com</a>.</td>
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May 5-9 New Orleans, LA Process Safety Management Compliance & Compliance Auditing combined course. ABS Consulting; (800) 769-1199; www.absconsulting.com/training.


May 6-8 The Woodlands, TX Lean Behavior-Based Safety Certification workshop. ProAct Safety; (800) 395-1347; www.LeanBBS.com.

May 6-9 Decatur, IL OSH Standards for General Industry Trainer course. National Safety Education Center; (800) 656-5317; www.nsec.niu.edu/nsec.


May 12-14 Kansas City, MO OHST Certification Preparation workshop. SPAN International Training; (855) 357-7726; www.spansafetyworkshops.com.


May 19-22 Indianapolis, IN VPPPA Region V Conference. VPPPA Region V; www.vppregionv.com.


May 20-23 Palm Beach, FL Qualified Person Fall Protection for Engineers course. High Engineering; (403) 287-0475; http://highengineering.com.


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April 7-9 Crystal City, VA
May 5-7 Seattle, WA
June 6-8 Orlando, FL
June 12-14 Orlando, FL
July 14-16 Reno, NV
August 4-6 Baltimore, MD

CSP WORKSHOP
April 10-12 Crystal City, VA
May 8-10 Seattle, WA
June 6-8 Orlando, FL
July 17-19 Reno, NV
August 7-9 Baltimore, MD

MATH REVIEW
April 6 Crystal City, VA
May 4 Seattle, WA
June 5 Orlando, FL
July 13 Reno, NV
August 3 Baltimore, MD

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ASSE Gearing Up for First International PDCs in May 2014

ASSE members agree that professional development conferences (PDCs) both national and regional are a valuable benefit to members and the global safety community, as they allow practitioners who attend to join the discussion on issues facing the profession, hone their skills, share best practices and network.

ASSE’s first PDC was held in Chicago, IL, in 1962. Since then, the event has grown tremendously, both in the quality of its programs and the number of attendees. Last year in Las Vegas, NV, the Society hosted a total of more than 8,000 attendees, including participants and exhibitors from more than 40 countries.

ASSE is also well established in the Middle East, in part due to two successful conferences in the region, hosted biennially by the Middle East and Kuwait chapters since the late 1980s. The upcoming 11th Professional Development Conference and Exhibition, titled “Innovative Approach Toward Emerging SHE Challenges,” will be held March 16–20 in the Kingdom of Bahrain (http://asse-mec.org/2014).

As the Society continues its global growth, ASSE strives to make its benefits more accessible globally. While ASSE’s annual U.S. conference is open to all, cost and time required to travel to and from the U.S. are prohibitive for many international members.

Thus, ASSE is piloting two regional PDCs: Lagos, Nigeria, May 21–23; and Chennai, India, May 26–28. This will allow the Society to address the existing need for professional development among members, promote ASSE and its mission in these countries and allow local chapters to become more sustainable.

ASSE Nigeria Chapter leadership spearheaded the effort to organize a PDC that is designed to bring together more than 1,500 attendees from Nigeria and neighboring countries. While oil and gas are dominant industries, the conference will address topics beyond energy.

Construction and infrastructure development together with oil and gas contribute 43.2% of local GDP. It is reported by the Global Construction Prospective and Oxfords Economics that Nigeria is becoming a global hot spot. It is also reported that from 2009 to 2020, only Nigeria and India will enjoy higher growth rates than China in infrastructure output.

For information about the event in Nigeria, visit http://nigeria.asse.org.

As for India, for several years the Indian safety community has shown a growing interest in ASSE. More than 400 new members from India have joined. Professional development opportunities are key membership benefits that attract new practitioners in India.

Safety India 2014 will take place in Chennai, India, May 26–27, 2014, at the Leela Palace. The 2-day event will bring together an estimated 500 participants and 20 exhibitors from India and neighboring countries. A postconference seminar is scheduled on May 28 to address the need for global occupational safety credentials.

As a group of nine ASSE members who participated in a People to People program to India recently learned, the need for occupational safety in India is great. These observations were also confirmed by International Labor Organization’s report on occupational safety and health in India. This report, put together by a working group appointed by the Indian government, concluded that there is a lack of “uniformity and a well-coordinated approach to safety and health in all sectors of the economy except the mining sector.” By conducting this conference, ASSE hopes to spread its mission of advancing the profession globally and also benefit the Indian community and members.

For details, updates or to register, visit www.safetyindia2014.org.
Osha Publishes Its 2014 Intentions

Osha has published its regulatory agenda for 2014. ASSE's government affairs staff reports that while the agenda is ambitious and it appears that the agency's long period of no rulemaking by the agency may be coming to an end, "any intentions to take action or dates announced by OSHA need to be taken with a grain of salt," primarily due to resource issues, legal review requirements or various other factors that delay rulemaking.

Prerule Stage
- Bloodborne pathogens
- Infectious diseases
- Reinforced concrete in construction
- Preventing backover injuries and fatalities

Proposed Rule Stage
- Occupational exposure to crystalline silica (to view ASSE's comments on the proposed rule, visit http://bit.ly/1fBBE7W)
- Occupational exposure to beryllium;
- Combustible dust;
- Injury and illness prevention program;
- Confined spaces in construction;
- Electric power transmission and distribution/electrical protective equipment.

View the complete agenda at http://1.usa.gov/MSAzyn.

Nomination Deadline Soon: Innovation Award in Occupational Safety Management

The deadline is approaching for nominations for ASSE's inaugural Award for Innovation in Occupational Safety Management, sponsored by Cintas. The award will recognize individuals who have addressed workplace safety challenges in innovative ways. The winner will receive a $3,000 cash prize and be recognized at Safety 2014 in Orlando, FL, June 8-11.

The deadline for nominations is March 31, 2014. Visit www.asse.org/innovate for details on nomination criteria.
Design the Hazards Away

Following is an excerpt from "Design the Hazards Away: Prevention Is the Cure," by Michael C. Wright, Jeremy T. Deason and Mark E. Williams. The complete article is available as bonus content at www.asse.org/psextra.

The Solution

For the hazards to be eliminated, the entire building construction and maintenance process must be considered. Design professionals have a duty to design-in safety for each worker into every phase of every building project, from construction to maintenance. Owners, employers and safety professionals have the ability to stop paying for hazards by requiring that design professionals design out hazards with the same professional attention given to the technical detail as they would to designing or planning the building project.

Certain industries such as window washing, amusement parks and demolition have taken or are taking steps through consensus standards and laws to force safety to be addressed earlier. These terms prevention through design, construction hazards prevention through design and sustainable safety have a commonality in that each addresses the need for a new approach to design out hazards.

The problem with the solution rests in the fact that design professionals:

1) are not trained to recognize hazards;
2) feel they would be dictating ways and means that could expose them to greater liability;
3) do not think they have a legal, regulatory or contractual requirement to assess their designs for created hazards.

Currently in the U.S., the only thing policing the industry is litigation, or the fear of litigation. Consensus documents from ANSI and ASSE address this issue, but these are not laws. An official statement from American Society of Civil Engineers (ASCE) reiterates that design engineers have a responsibility for:

Applying the Solution

The Building Code, industry standards, OSHA regulations, litigation and contract language are a few things that drive safety. Each one has a little different use, jurisdiction or influence.

• OSHA, for the most part, is reactive: Law written and passed because enough injuries and fatalities occurred to justify saying “you cannot operate in this manner anymore.” It is the minimum standard for protecting employees from hazards.
• Architectural and engineering professionals use the Building Code to create safe structures and facilities. Similar to OSHA regulations, much of the code is based on trial and error. Failed structures are analyzed to discover why they failed, and the code is then updated accordingly.
• Industry consensus standards provide the agreed manner of operation or best practices within a particular industry. Sometimes OSHA adopts standards by reference and sometimes they are referenced in a general duty clause citation.
• Contractual language can be the factor on which many owners have the most influence to prevent hazards before they own them. Purchasing power can change an industry.
• Litigation can create incentive for manufacturers and design professionals to correct or address potential hazards but remain unctitable by OSHA. Often, litigation paves the way for development of consensus standards.

If given the option, why would we continue to purchase new hazards? The power of the purse goes a long way when change is desired. Industry leaders are stepping up and require manufacturers and designers to supply products or services that provide detailed instructions or engineered protection from hazards.

Owners, employers and safety professionals must contractually require design professionals to learn and incorporate sustainable safety design principles into every project or facility. Once preplanning to design out the hazards is implemented at the design phase, the direct result will be a drastic reduction in serious injuries.

References


Michael C. Wright, P.E., CSP, CPE, president; Jeremy T. Deason, P.E., director of engineering; and Mark E. Williams, director of training, are part of the consulting team for Safety through Engineering Inc. (www.ste4u.com), a pioneer in the integration of engineering and safety. All three are active members of committees developing industry standards for workplace safety requirements.

For more PTD information, read “Getting Started With Prevention Through Design,” on p. 63.
Reducing Injuries Among New Employees

Statistics show that new employees are more likely to injure themselves within the first year of employment than other employees. Many factors may contribute to these injuries, from inexperience to a lack of understanding of safety procedures. To address this issue, Kristen Chipman and Tricia Sweat developed a systematic approach for reducing workplace injuries, which they detailed in the session “Reducing Injuries Among New Employees,” presented during the 2013 National Safety Congress.

Established by Chipman, an SH&E professional at Cianbro Fabrication & Coatings Corp., and Sweat, SH&E manager at Graphic Packaging International, the approach features five steps:

1) Preplacement medical evaluation. For physically demanding jobs, preplacement evaluations ensure that new employees are physically capable of completing their assignments. Partner with a physician who can perform prescreening exams or evaluation analyses to indentify any preexisting conditions or injuries that may hinder performance. Doctors serve as third-party experts to evaluate worker conditions and can be helpful in setting up work modifications.

2) Work modifiers. When new employees have restrictions, employers can set up modifications to ease employees into a workload. Some employees can assume a normal workload quickly while others may need more time. To ensure both parties’ commitment to safety, these special work modifications should be accompanied by a signed agreement with the worker and should include work-restriction reporting. Workers and employers should continue to track changes annually and adjust restrictions accordingly.

3) Orientation. Sweat and Chipman stressed the importance of orientation, as it is the first impression for new hires. Orientation is an opportunity to make all company policies and safety expectations clear, and workers should be tested for comprehension.

4) Mentorship. Mentorship programs are a great way to boost teamwork, form long-lasting relationships and mold new hires into seasoned professionals. These programs allow employers to select established employees whose behaviors they would like to see modeled and provide new employees with one-on-one mentoring. Employers must consider choosing a mentor based on several qualifications in addition to their work performance to ensure continued success.

5) Behavior-based safety. Behavior-based safety programs promote improved safety awareness and success in identifying at-risk behaviors. These programs encourage blame-free feedback on performance and reinforce safe behavior and workplace conditions for both new and veteran employees, Chipman says. She believes that these programs help create a more unified safety culture.

NHTSA Uses Technology to Improve Highway Safety

National Highway Traffic Safety Administration (NHTSA) has launched an initiative to reduce the number of deaths and injuries on the nation’s roads. The Significant and Seamless Initiative aims to accelerate technological development in three key areas of highway safety, including failure to use seat belts, drunk driving and driver error.

The agency is working with the automotive industry to research and develop seat belt interlocks, driver alcohol detection system, and forward collision avoidance and mitigation. Visit www.nhtsa.gov to learn more.
OSHA’s Proposed Silica Rule: Your Questions Answered

In September 2013, OSHA proposed a rule to lower worker exposure to crystalline silica in operations involving cutting, sawing, drilling and crushing of concrete, brick and other stone products, as well as in operations that use sand products, such as glass manufacturing, foundries and abrasive blasting. When inhaled, airborne silica dust has been identified as a cause of lung cancer, silicosis, chronic obstructive pulmonary disease and kidney disease. OSHA estimates that the rule could save as many as 700 lives per year.

On Jan. 14, 2014, OSHA held an online chat, during which safety professionals and other stakeholders could ask questions about the proposed rule and receive immediate responses from OSHA staff. Here is a sample of the questions and answers communicated during the chat.

Q: What major changes will the rule bring about?
A: The proposed rule includes a new lower permissible exposure limit (PEL), as well as requirements for air monitoring, medical surveillance, use of engineering controls and PPE. None of these will go into effect until the rule is finalized.

Q: When will the rule be finalized?
A: OSHA has not yet established a timetable for the issuing of the final rule. Following the public hearings, parties who filed a notice of intent to appear will be able to submit post-hearing comments and post-hearing briefs. OSHA will then use this information to begin developing a final rule based on the best available evidence in the complete rulemaking record.

Q: When will construction companies have to comply with the rule?
A: The proposed rule would become effective 60 days after the publication of the final rule in the Federal Register, and all obligations except engineering controls and laboratory requirements would become effective 180 days after the effective date.

Q: How will the new rules be more effective than current standards?
A: OSHA’s current exposure limit for silica in construction is outdated, as it is based on an obsolete air sampling and analytical method that has not been commonly used for more than 40 years and is no longer available. Additionally, peer-reviewed risk assessments performed by OSHA, NIOSH and others show that exposure at the current general industry PEL still results in significant risks of death from lung cancer, kidney disease, silicosis and other lung diseases.

Q: What types of silica are covered by the rule?
A: The proposed rule covers occupational exposure to respirable crystalline silica, defined as airborne particles that contain quartz, cristobalite or tridymite.

Q: How much more stringent is the new PEL?
A: The proposed PEL is 50 μg/m³. This is approximately one half of the current general industry PEL.

Q: Has an estimated cost to employers been established?
A: The proposed rule is estimated to result in annual costs of about $1,242 for the average workplace covered by the rule, based on information available at the time the proposal was issued. The annual cost to a very small firm (fewer than 20 employees) is estimated at $550.

Q: What are the medical surveillance requirements?
A: Under the proposed rule, employers would be required to offer medical surveillance every 3 years to workers exposed above the PEL. Medical surveillance would include a physical exam, chest X-ray and lung function testing.

Q: What are the main training elements of the proposal?
A: Employers would be required to ensure that each affected employee can demonstrate knowledge of the silica standard, operations involving silica exposure, procedures to protect employees and the medical surveillance program. See paragraph (i) of the proposed rule for more precise language.

Q: What are the main training elements of the proposal?
A: The handbook helps expand the safety culture within Gerdau workplaces around the globe.

Steel Company Gerdau Receives Industry Award

Gerdau, a long steel producer and supplier, received the 2013 Safety and Health Excellence Recognition Award at the 47th Annual Conference of the World Steel Association. The award is given to a company within the steel industry that successfully implements a safety and health program.

Gerdau (www.gerdau.com) received the award for its “Handbook on Behavioral Management in Occupational Safety,” which details its best practices for behavioral management gathered from experiences found in Gerdau units worldwide. The handbook helps expand the safety culture within Gerdau workplaces around the globe.
Operation Quick Strike Shuts Down Unsafe Bus Companies

In an effort to stop unsafe motor coach operations, DOT’s Federal Motor Carrier Safety Administration (FMCSA) shut down 52 bus companies and 340 vehicles that failed in-depth safety reviews. The 8-month long Operation Quick Strike was part of FMCSA’s three-phase motor coach safety initiative to “raise the bar for safety” in the industry.

U.S. Transportation Secretary Anthony Foxx says that as bus travel increases in popularity, safety must remain a top priority. “Through Operation Quick Strike and our regular enforcement efforts, we’re shutting down companies that put passengers at risk and educating the public on safe motor coach travel,” Foxx says.

FMCSA reports that companies were shut down due to failures to maintain buses, inadequate drug and alcohol driver testing programs and widespread hours-of-service violations. People planning on traveling via bus are encouraged to visit www.fmcsa.dot.gov/LookBeforeYouBook for tips and information before buying a ticket. In addition, the agency’s SaferBus mobile app (http://goo.gl/tKywwv) provides bus company reviews and safety records. Visit http://goo.gl/idMXNL for more information.

Final Rule Requires Seat Belts on Motorcoaches

National Highway Traffic Safety Administration (NHTSA) issued a final rule requiring all new motorcoaches and other large buses to provide seat belts for each passenger and driver. According to NHTSA data, each year an average of 21 people are killed and nearly 8,000 are injured when these vehicles crash. Requiring lap and shoulder seat belts may reduce the risk of fatalities by up to 44% and injuries by up to 45%, by reducing the risks in frontal crashes and the risk of occupant ejection in rollovers. Visit www.nhtsa.gov to learn more.
Cintas Outlines Strategies for Improving PPE Performance

According to BLS data, many injured workers admit to not wearing PPE. Cintas Corp. offers seven recommendations for improving PPE performance:

1) Keep PPE in a central location. The firm recommends investing in a PPE cabinet that is part of a managed program to keep gear adequately supplied and maintained.

2) Ensure that ear plugs fit correctly and comfortably. Often the reason employees do not wear hearing protection is that it is uncomfortable.

3) Offer antifog eye protection, particularly in high-humidity environments.

4) Match gloves to hazards and seasons. Organizations should match hand protection to the tasks being performed, conditions of the work and duration of use.

5) Check protective apparel for imperfections. Arc-flash gear must be checked regularly for imperfections to ensure that employees are properly protected.

6) Provide hard hats in various types and classes, and make sure that workers know when to use each type and class.

7) Offer safety training to supplement PPE use. Protective gear is only effective when the user is knowledgeable and responsible about the equipment. Workers should complete training that highlights job hazards, the importance of PPE and how to properly wear it.

For more information, visit www.cintas.com/safe.
Know Your Workers: Are They Safety-Oriented or Risk Takers?

Many companies have successfully mitigated risk through proper equipment and safety training, but data show that despite these efforts, companies still lose billions of dollars a year to workplace injuries.

According to studies by TalentClick, a Canadian research company, the direct costs from workplace incidents are more than $51 billion a year in workers’ compensation payments, medical expenses, civil liability damages and litigation expenses. These costs are multiplied by the indirect costs of on-site incidents and illnesses.

Through a series of studies with outside organizations, Stephen Race, head of research at TalentClick, and his team discovered a strong correlation between five personality characteristics and workplace safety incidents. The five core risk-related traits include resistance, anxiousness, irritability, distractibility and impulsiveness. Individuals who are considered higher-risk in any of these categories, Race says, can be a threat to their own safety and that of others.

By concentrating on these five traits, employers can identify whether workers are more prone to be safety-oriented or at-risk based on their default personality. To help organizations identify high-risk workers, TalentClick developed several web-based personality assessment solutions for workers, managers and recruiters.

While Race says personality traits are just one overlying factor in a series of issues that could lead to an incident, research shows that by hiring safety-oriented workers or creating an environment that promotes safety-oriented workers, companies will, over time, begin to see increased productivity, fewer lost-time injuries, improved safety scores, enhanced morale and employee engagement, improved corporate image, and reduced compensation claims and lower insurance premiums.

For more information, visit www.talentclick.com.

Five Characteristics

Resistant: Higher-risk individuals who tend to disregard authority and rules and are resistant to feedback, while lower-risk individuals tend to comply with rules, follow training and guidelines.

Anxious: Higher-risk individuals who tend to freeze or panic when faced with unexpected safety-sensitive situations, and may doubt their abilities, while lower-risk individuals tend to be confident and calm under pressure.

Irritable: Higher-risk individuals who tend to be easily annoyed, especially when under stress, while lower-risk individuals tend to be less irritable and are able to control their emotions under stress.

Distractible: Higher-risk individuals who tend to seek stimulation, and may lose focus easily, while lower-risk individuals are less likely to become distracted and can stay focused and alert.

Impulsive: Higher-risk individuals who tend to seek excitement, take risks and may underestimate the consequences of their actions, while lower-risk individuals tend to be more careful, evaluating their options before making decisions.

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Nirupam Mukherjee

PS: Describe construction safety challenges that are unique to Asian countries.
Nirupam: There are a few challenges in highly advanced, high-tech countries such as Japan and Korea and others in India and neighboring countries. The construction industry is not as mechanized as other industries and is more dependent on manual labor, so there are a lot more behavioral issues and human errors. Another challenge in Asia is the kind of contractors we typically get at construction sites. Over the past 10 to 15 years, I don’t think that contractors really geared up for safety challenges as much as they did for new orders and new opportunities.

PS: How would you promote safety among construction personnel whose work sites do not meet global safety expectations?
Nirupam: Promoting safety appears to be a giant challenge, especially for multinational companies and Asian clients that really care about safety. The strategies that Praxair adopted, and that most other multinational companies adopt, is to become vigilant about contractors. A rule book and a signed contract do not go a long way in executing project safety with unfamiliar contractors. We try to be more proactive; we try to anticipate where contractors might fail. So we adopted a few strategies, and I categorize them in five basic points:

1) Hire the right people. We spend a lot of time hiring the right contractors who have some kind of exposure or at a minimum, are willing to elevate the standards to global benchmarks. As a minimum, are willing to elevate their standards and unskilled workers. It takes time but we keep monitoring their quality.

2) Invest ample time and energy in finding the right contractors. Before hiring them, for example, we take them to sites that are operating to our expectations. We take their leadership team and key personnel to observe the construction site so that they understand how we manage safety, how we deal with things differently than they do, what kind of extra initiative it takes, what kind of extra cost it takes, what kind of people they need and what kind of training they should provide.

3) Once we see that they are good candidates, we show them pictures that are examples of how to do things and explain procedures to their field execution team that will oversee their workers and subcontractors.

4) As they gear up for mobilizing to the site, we look around the site and create a very strong team to support them so that they begin in a more organized manner. Planning can be a weak area for contractors.

5) As they begin to work, we have to deploy a strong team of safety inspectors, observers and auditors to constantly evaluate their performance.

PS: What causes gaps in worker safety training and what can be done to ensure that it is more thoroughly addressed?
Nirupam: What we see in developing countries is that most industrial and construction workers have backgrounds in farming. They do not come from an organized sector. In recent years, we have people coming from technical training institutes sponsored by the government in various countries. But unskilled people from unorganized sectors such as farming make up about 64% of the typical construction site workforce. The result is that they never get an opportunity to receive structured safety, operational or behavioral training. Complicating the situation is that culturally, many of the workers come from villages and bring a bit of superstition, fatalism and other deep-seated behavioral traits that can be difficult to change.

Fortunately, we generally have workers who take direction well and have a sense of respect. If you can exhibit a sense of responsibility, care and compassion to your workers, it is possible to change their behaviors and learning. Of course, the learning process is initially tough; it takes some time. But connecting to this workforce at a psychological level is important, and if you value what you say, it is easier for them to figure it out.

We teach these contractors how to teach themselves. For a few days or months, we use our trained safety professionals. At the same time, we train their safety engineers to develop the training matrix to our standards, then we deliver field-based and classroom training for the skilled and unskilled workers. It takes time but we keep reusing these contractors on projects, so the initial investment goes a long way. On the second and third projects we do not have to invest a lot of time, rather we keep monitoring their quality.

PS: Provide an overview of your contractor selection process.
Nirupam: For multinational companies and Asian companies that have a vision of running their construction sites and projects safely, the first thing they must do is identify construction contractors who are specialized in a similar kind of construction.

For example, if a company that builds petrochemical projects would not hire construction people who are only focusing on civil areas. The company would start looking at contractors with big gas, oil or refinery projects. We create a database of contractors that have worked with...
our company or similar companies. Once they are in the database, we try to reach out to practically every potential contractor. We keep driving home that whoever comes to work for us, safety has to be their first priority. That element eliminates a few contractors who think that they have an easier choice than working for a top client with these safety training measures.

Before we start our bidding process, we invest time, money and our expertise in traveling to at least two active construction sites of the prospective contractors. We go to their clients’ construction sites with permission on both ends. We do an informal assessment to understand their safety management program. We talk to their safety people separately and try to gauge their safety culture. We try to see how visible safety is in their workplace. With their permission, we talk to some workers to understand how tolerant and competent in safety these workers are and how well they are taken care of by this contractor. This gives us a high-level view of how these contractors work.

We also use a scoring matrix so that the team that visits the construction sites assesses these contractors in various areas. Some may be strong on personal protection, yet weak in electrical safety. We take the scores of different prospective contractors and evaluate who is the best choice. We evaluate all the aspects. First we get their safety scores, followed by expertise and power in executing projects. Cost and quality may also be evaluated, but we cannot put cost as the first priority for safety contractors.

**PS:** What does safety orientation consist of for prospective contractors?

**Nirupam:** The orientation is two-fold. The first part takes place in the office. We develop an elaborate safety presentation to address the safety manual section by section. We came across several contractors who had already signed our safety contract, taken the manual, but later we found that they did not read it. We ensure that the leadership team is dedicated to section-by-section comprehension of the safety manual. Then we show prospective contractors key studies of the different kinds of incidents that we don’t want to see on the construction sites. On the other side, we show them pictures of similar processes and practices the way we want them to be performed on construction sites. It is a day-long exercise. Then we schedule their visits to our construction sites so they can see real-world examples.
Leading Thoughts

Safety Gone Viral
How to Get Innovations Adopted
By Dianne R. Stober

How many times have you tried to institute a new practice, get people to adopt a new way to look at safety, or use improved equipment only to encounter resistance? Have you ever wondered why some safety initiatives fizzle and others take off? Achieving critical mass is key to any change becoming part of the culture. But how?

Social scientists have spent decades researching how innovations and change are adopted (or not) within social groups. Sociologist Everett Rogers (2003), synthesized hundreds of studies across the world to develop his model of how change spreads and is adopted. In his model, two key principles are involved in achieving critical mass:

1) know where people relate to adopting a change;
2) understand the characteristics of the innovation that will influence whether individuals will adopt or reject the change.

Know Where Your People Are
People vary in how ready they are to adopt change (Stober, 2009). When it comes to new initiatives or innovations within a group, individuals tend to fall into predictable categories of who adopts a change when. Rogers (2003) describes five categories of individuals related to any innovation: Innovators, early adopters, the early majority, the late majority and laggards. Being able to identify who is in what category can improve any safety professional’s plan for getting a new initiative adopted.

Innovators
Innovators are the first people to adopt. They take risks to make change; failure is not a huge concern. While this willingness to risk a change means it is easier to get innovators to adopt a new idea, they have some characteristics that can decrease their influence in the larger group. They are sometimes seen as idealistic and different from others in their group. Innovators are often out in front of the group; change may come from them, however, often they are not the change agent that gets a new initiative adopted. Innovators enjoy experimenting and being on the forefront, so safety professionals can leverage their strengths by engaging them to brainstorm new approaches and try things out early. It is important to recognize that while innovators are creative and great sources of ideas, safety professionals will likely not be successful if they lean on innovators as their main champions or spokespeople.

Early Adopters: The Trendsetters
Early adopters, or trendsetters, scan constantly for innovations that will help them move forward. Trendsetters tend to be strategic thinkers and are willing to be guinea pigs if they see an advantage to the new initiative. They tend to be an easy audience willing to entertain a new idea and can be great advocates. They sometimes can still be seen as too different from the pragmatic majority, but if not, key opinion leaders are often found in this category. The effective safety professional can recruit trendsetters to test new products and initiatives. This category is also where safety professionals want to look for their champions who will effectively spread the message throughout the organization.

The Early Majority: The “Show Me” Folks
The early majority, or the “show me” folks, are comfortable with progressive ideas but need observable results to adopt a change. They tend to dislike complexity and can be more sensitive to what the change might cost them. Safety professionals trying to influence show me folks need to demonstrate the value of a new initiative to win them over.

The Late Majority: The Reluctant Joiners
The late majority, or the reluctant joiners, tend to be pragmatists who dislike risk and are less comfortable with new ideas. However, if they sense the wider group is moving toward a new initiative, they will work to fit in. Consistency is important to reluctant joiners, so safety professionals should communicate how new practices or initiatives fit in the big picture.

Laggards: The Stubborn Mules
Laggards, or the stubborn mules, are well known to most safety professionals. Stubborn mules see high risk in adopting change. They often fear change and do not like unfamiliar situations. To influence this group, safety professionals will want to use opinion leaders who can help laggards feel comfortable.

It is critical to understand that getting individuals to change categories is unlikely. A laggard is unlikely to be an innovator or trendsetter. Rather than trying to convert people into a different category, it is more helpful to think about how to move an innovation through the different groups of adopters. To move an innovation forward, it is important to recognize that each adopter category tends to evaluate the value of a particular innovation differently.

Innovation Characteristics That Influence Adoption
Rogers (2003) identifies five qualities of innovations that influence adoption. He shows that when an innovative idea or product had enough of these characteristics, adoption within a group was more successful. Further, he defines which characteristics were most influential within adopter categories.
1) Relative advantage. The greater the perceived advantage, the quicker it catches on.

2) Compatibility. The more compatible and consistent the innovation is with the organization’s values and norms, the easier the innovation will be adopted. For reluctant joiners, compatibility with values and norms is a must. This also becomes important for stubborn mules to fall in line.

3) Simplicity. The easier the innovation is to understand, use or put into practice, the more likely it is to be adopted as a positive change. User-friendliness is important to the show me folks and laggards.

4) Ease of trying it out. The easier the innovation is to experiment with or try out, the better. Being able to trial the change is key to getting trendsetters on board.

5) Observable results. The easier the innovation is to see or assess, the less uncertainty is present and the easier it is for discussions among peers. For an innovation to be adopted by the show me folks, results must be observable and adopted by respected others. Stubborn mules also need to see that others have succeeded in making the initiative work.

Knowing which of these qualities to leverage with which type of adopter can help a safety initiative go viral. The safety professional trying to get a new idea adopted must demonstrate how that idea meets the criteria important to the people in the adopter category s/he is trying to reach. While easily being able to try out the innovation is a key characteristic for trendsetters, this is not a selling point for the show me folks. The show me folks need to be able to easily see results of how well something works before they will even think about trialing the new idea. Clearly, understanding how to talk about an innovation, when and to whom can make a huge difference in reaching critical mass for adopting a change.

A Case Example: A New Type of Training Program

Don, the SH&E director of a large industrial construction company, saw a new training program that uses tablet devices to deliver cognitive safety training in the field. He saw several advantages to using such an approach and knew he first needed to get the decision makers and primary stakeholders on board. He also knew that getting the program accepted in the field presented challenges, as many workers had talked about past SH&E initiatives as flavors-of-the-month.

Decision-Maker Approach

Don knew he would need to convince several key people that the training program was a good investment: the business unit president, the SH&E manager for the business unit in which he wanted to deploy the program and several operations managers. Don also recognized that within this decision-maker group, he had an innovator, a trendsetter, some show me folks and reluctant joiners, and one stubborn mule.

Chuck, the innovator operational manager, was always ready to try something new. Don knew it would be relatively easy to get Chuck on board, but also recognized that Chuck would not be his most effective champion to enlist others’ support. Although Chuck was bright and quick to recognize new advantages, he was also seen by some managers as a bit of a loose cannon, always on to something different. He had a track record of trying several new approaches, only some of which worked, so people were often skeptical of something seen as his idea.

Don saw a better champion in Terry, the project manager, who seemed to be a trendsetter with the respect of the organization. Once Terry saw the benefit of an initiative or product, he was quick to get involved. Since he was seen as someone who knew how to get things done right, Don saw the advantage of getting Terry involved early and asking him to be part of a team talking with different stakeholder groups.

Dave, the business unit president, showed characteristics of a show me adopter. If Dave bought into the program’s advantages and clearly understood how a trial run would be assessed, Don knew that he would get behind the initiative. Dave had gotten to his present position by backing solid efforts and demanding results. Among the other operational managers, Steve and Jack were reluctant joiners. They were not going to jump on any bandwagons, but if the program was accepted by other leaders and had a good business case for safety performance, they would likely agree to participate.

Don knew his biggest challenge would be convincing Janet, the vice president of finance, that the investment in this training program, the tablets themselves and the approach would pay off. Janet was known as being a tough sell on anything new. While not being antagonistic toward SH&E efforts, she was often the last one to join any new initiative and seemed to be somewhat removed from safety.

So how did Don tackle this group of decision makers? His first steps were to educate and excite his SH&E staff about what this new way of training might deliver. It was mobile and relied on job-relevant examples broken up into microtrainings (Stober & Putter, 2013, p. 41). Then he set a meeting with Dave (the president) and Terry (the project manager) for an initial discussion.

In that meeting, he described the relative advantages of the initiative:

1) The facility had an ongoing issue with relatively minor incidents and was seeking to learn “where
people’s heads are at.” This approach achieved that.

2) An approach like this brings safety awareness into daily discussion in the field by deploying the training for 15 minutes at the start of shift. Thus, it would have little impact on production, especially compared to classroom training, and small chunks are an effective learning method.

3) The delivery method was appealing and easy to use (tablets are “cool” and if someone could use an ATM, they could use the tablet app). This advantage also reflected the program’s simplicity.

4) The site was already looking to use more apps for other field purposes, so tablets were currently under discussion.

Next, Don discussed the ease of trialing in terms of a pilot deployment to both work out logistics and to get observable results, which Don knew would be key to getting Dave’s support. He also knew this would appeal to Terry’s interest in being on the forefront of a new, promising initiative and in being able to have input into how it would progress. As an added point of discussion, Don promoted this initiative as an avenue for promoting this initiative as an avenue for leading opinion leaders to help drive the effort. Again, rather than trying to get a stubborn mule on board at the start, they focused on selecting a project for which they had enough trendsetters who were respected opinion leaders to help drive the effort. Again, rather than trying to get a stubborn mule on board at the start, they focused on selecting a project for which they had enough trendsetters who were likely to fairly easily adopt the initiative as a positive move forward and who could credibly demonstrate its value.

As the pilot rolled out, the team continued to identify opinion leaders among trendsetters and reluctant joiners who could be enlisted as champions and spokespersons for the value of the program. They also identified innovators and trendsetters who could be on the frontier of gathering feedback and anecdotes of how the program was being used and success stories. As time progressed, the results and stories became tools to help reluctant joiners and laggards see that this training program was becoming a valued aspect of the safety culture of their group. Show me folks saw the benefits of participation. As more individuals adopted the training program as a good thing, those lagging behind were likely to feel some pressure to conform or risk being seen as an outsider.

Conclusion
The adoption of a safety initiative will only go viral when critical mass is achieved. When enough people see the innovation as valued or even inevitable, its adoption and sustainability become viable. Safety professionals can benefit from abundant research that reinforces two key points for gaining critical mass: 1) understanding the different types of people; and 2) knowing the essential characteristics of innovations that get the different types of people to adopt something new. To get a safety innovation to go viral, the SH&E professional can increase his/her success by acting on the following:

1) Which key individuals are in what adopter categories? Create a map of who is where.
2) How does my proposed innovation meet each of the five characteristics of successful innovations: relative advantage, compatibility with existing norms, simplicity, ease of trialing and observable results? Develop talking points for each.
3) Develop a communication plan for mapping talking points to the adopter categories of the key individuals. Know your audience and what their biggest concerns are. 
4) Who needs to be approached early to get involved in brainstorming and input? How can I use innovators most effectively?
5) Who are my opinion leaders? What categories are they in and when/how will I engage them?
6) Once an innovation is being implemented, who are the spokespeople who will enlist further adopters?
7) How will I address reluctant joiners and stubborn mules? Rely on their sense of wanting to fit in? Use opinion leaders to address the characteristics of innovations to which they are most responsive?

Understanding how innovation and change spreads through an organization is vital for safety professionals. Change is hard enough for individuals; organizational change takes even more effort. The safety professional who understands how innovations are adopted within cultures is likely to succeed.

References
Healthy Workplace Project
Creating Healthier, More Productive Workplaces
By Siobhan Lally

Kimberly-Clark Professional has a long history of providing product solutions to its customers, but a few years ago the company decided to provide a broader service that would not only deliver cleaning and hygiene products, but would also help customers create healthier, more productive workplaces.

Known as the Healthy Workplace Project (www.healthyworkplaceproject.com), this initiative launched in 2010 and includes not only Kimberly-Clark products but also provides businesses with tools and knowledge to keep workers healthy, says Elane Stock, president of Kimberly-Clark Professional. Through education, communication and workplace wellness programs, the project aims to reduce workplace absenteeism and lost productivity that occurs when employees are stricken with colds, the flu or other contagious ailments.

Companies in the U.S. lose an estimated $74 billion a year due to lost productivity and absenteeism, and on an individual basis, companies lose about $16,000 per employee, per year, due to both absenteeism and presenteeism, Stock explains. “The Healthy Workplace Project provides the tools and materials that help businesses combat cold and flu germs in the workplace through workplace wellness programs,” she says.

Creating a healthier culture begins with the three simple concepts of the “Hygienify” routine.

1) Wash. Proper hand washing is the first and best defense against spreading sickness and germs throughout the workplace, according to Kimberly-Clark. Research shows that washing with soap and water for at least 20 seconds, paying particular attention to the back of the hands, in-between fingers and under the nails and thoroughly drying with paper towels can reduce germs by 77%. Kimberly-Clark notes it is important to wash before making/eating lunch, after using the restroom, after coughing or sneezing, and after touching the garbage or any other contaminated surface.

2) Wipe. Data show that germs can live on surfaces for as long as 48 hours. High-traffic areas such as break rooms, handrails, doorknobs, keyboards and conference tables are perfect for transmitting unwanted germs because so many people touch these surfaces and transfer germs without ever knowing it, Stock says. Cleaning high-touch surfaces (hot spots) daily with sanitizing spray or a wipe, even if they appear to be clean, can greatly reduce the spread of germs.

3) Sanitize. According to statistics, using hand sanitizer can reduce sick days by 21%. Viruses can be transferred between people up to six times, so, using hand sanitizer before and after interacting with others can greatly reduce the likelihood of spreading germs, as sanitizer kills 99.9% of the most common disease-causing germs. Hand sanitizing dispensers can be placed in high-traffic areas with no access to soap and water.

Every surface or interaction with a person is another opportunity to spread germs, says Stock, but evidence shows that “following a wash, wipe and sanitize protocol in the workplace can reduce contamination of surfaces by 62%.”

Healthy Workplace customers can provide employees with Healthy Workplace Project desk caddies, which provide access to tissues, hand sanitizer and disinfectant wipes. However, in addition to products and following the Hygienify routine, spreading awareness is key, Stock says. “What we find is that having products is only one piece of the puzzle. It is really about building awareness among people and changing their behaviors. It’s not just having the right product, it’s about having the right awareness, having the behavior change, and really drawing the connection between what employees do and how they can really take control of preventing illnesses,” she says.

To build awareness and help organizations reduce absenteeism, the company has developed materials to educate and engage employees. Some online tools are available, including office communication materials and newsletters that employers can print and display throughout the workplace to encourage employees to follow the wash, wipe, sanitize regimen and take the Healthy Workplace pledge.

Another tool offers an in-depth look at different hot spots for levels of contamination, and an added resource examines the number of germs employees face on their daily commute.

Hot Spot: Did you know 75% of break room sink faucets contain high levels of contamination?

Although these are all free resources, the company offers its customers a unique set of tools to match specific needs. The project is designed to be customizable to meet the customers’ individual needs, Stock says. A representative assesses clients to gain a better understanding of their needs, then provides product solutions, e-communications and educational information such as pamphlets, cling stickers, posters to distribute throughout the workplace to encourage behavior change and help create healthier workplaces.

Last year, before the flu season, the Kimberly-Clark Professional team encouraged employees to participate in a 90-day challenge specifically focused on communication around the upcoming flu season. Employees participated in games, online interactive activities and some daily and weekly challenges. The company found that in addition to increasing employee engagement in the wash, wipe and sanitize protocols, there was an overall $130,000 in annualized savings on medical claims and a self-reported 3% increase in self-reported productivity, Stock says.

“It was a great way to recharge people’s understanding of how germs are transmitted and what they can personally do to help stop that process,” she says.

Siobhan Lally is a communications and design assistant for ASSE and part of the editorial staff for Professional Safety. She holds a B.A. in Journalism from Columbia College.
In addition to improved productivity and cost savings, Kimberly-Clark conducted some before and after surveys of clients and found an overwhelmingly positive response from employees who were asked if they felt healthier and more engaged.

Ultimately, keeping a healthier workplace has several benefits, Stock says. “There is a real impact from having employees who are healthy, including reductions in the cost of absenteeism, increased productivity and improved safety and employee engagement,” she adds.

Following these rules alters employees’ attitudes as well as protects them from becoming sick during flu season and throughout the year, says Stock. For more information on the Kimberly-Clark Healthy Workplace Project, including videos and newsletters, visit www.healthyworkplaceproject.com.

More Tips to Minimize the Spread of Germs

According to CDC, the best defense against the seasonal flu is to get vaccinated each year in advance of the cold and flu season. In addition to vaccination, good habits such as covering your cough, washing your hands and eating right can stop germs in their tracks. Here are some actions that can help minimize the spread of germs:

1) Avoid close contact with others. Viruses are easily transmitted from person to person, particularly in close quarters like offices. Avoid close contact with people who are sick, and if you are sick, stay home or keep your distance from others.

2) Cover your mouth and nose. Viruses are primarily transmitted through mucus, and can stay on surfaces for up to 48 hours. Cover your mouth with the inside of your elbow and nose with a tissue when coughing or sneezing to help prevent spreading germs.

3) Clean your hands often. Washing hands before and after handling food or touching contaminated surfaces will help prevent the spread of germs. An alcohol-based sanitizer can be used as a substitute when soap and water are not available.

4) Avoid touching your eyes, nose or mouth. Germs are often spread when a person touches something that is contaminated with germs then touches his/her eyes, nose or mouth. Avoid touching your face, and continue to wash and sanitize often.

5) Clean high-traffic surfaces. Studies show that telephones, desks, microwave door handles and computer keyboards are hot spots for germ contamination. Clean and disinfect these high-touch surfaces often, especially when someone is sick.

6) Practice other good health habits. Get adequate sleep, stay physically active, drink plenty of fluids, eat nutritiously and manage your stress to stay healthy.

For more information and resources, visit www.cdc.gov/flu.
**Society Elections: Make an Informed Decision**

It is election time again, and ASSE needs your vote. Members who vote for Society leaders take action to become involved and help ASSE reach its future goals. Platform statements are available online at [www.asse.org/elections](http://www.asse.org/elections) to help members make an informed decision. Be sure to vote before March ends, as results will be announced in April.

**Innovation Award Deadline Is March 31**

ASSE’s new Award for Innovation in Occupational Safety Management recognizes the efforts of individuals for their innovation and creativity in managing safety in the workplace. Sponsored by Cintas, the award also serves as a way to commend innovative solutions needed to keep workers safe each day.

Applications are due March 31, 2014. For complete information, visit [www.asse.org/innovate](http://www.asse.org/innovate).

**Share Your News With Fellow Members**

*Society Update ([http://societyupdateasse.org](http://societyupdateasse.org)) is your member e-newsletter. Tell us about your activities and accomplishments, and share those stories with other ASSE members. Just send us the “who, what, when, where, why” along with a photo or graphic that complements your story, and we will do the rest. Here are some examples:

- Were you recently hired, promoted or did your company recently hire or promote an ASSE member? Send us your safety-related accomplishments so that other members can be inspired.
- Is your chapter actively involved in the community? Did the chapter recently hold a conference or event? Chapter news can help spark ideas and get other chapters involved too.
- Do you have a son or daughter who followed in your footsteps into the SH&E profession? Or did you follow someone into the safety field? We’d like to hear your SH&E Generations story.

Send your submissions to Cathy Baker, cbaker@asse.org.

**Get to Know ASSE’s Health & Wellness Branch**

Although ASSE’s Health and Wellness Branch is under the Society’s Healthcare Practice Specialty, the branch focuses on health and its impact on safety, rather than healthcare. As Deborah Fell-Carlson writes in an informative article, “As safety professionals, we may not think about the fact that healthy, alert workers suffer fewer on-the-job injuries and recover more quickly when hurt. This can have significant impact on our workers’ compensation costs. Although it may be difficult to measure the impact, we know that managing wellness and injury together is a win-win.”

The branch is eager to guide other safety professionals to help shape worker attitudes, thinking and behaviors that may result in improved personal and global health and well-being. For more information on the branch and how to become involved, visit [www.asse.org/practicespecialties/healthandwellness/index.php](http://www.asse.org/practicespecialties/healthandwellness/index.php).

**Safety 2014 Registration Is Open**

Registration is open for the profession’s premiere event of the year: Safety 2014. The event is scheduled for June 8-11, at the Orange County Convention Center, Orlando, FL. This year’s conference features opening general session speaker Charles Duhigg and general session speaker Sidney Dekker. Duhigg, a Pulitzer-prize-winning staff writer at the New York Times, and author of *The Power of Habit*, will discuss why habits exist, why they are important and how they can be changed. Dekker, a professor and author, will present his ideas on human factors and safety, and how the absence of a just culture can hurt safety.

Visit [www.safety2014.org](http://www.safety2014.org) to learn more.
ASSE Governance Update
Ensuring Relevancy in an Ever-Changing World

In the series of governance articles that have been published monthly in Professional Safety since April 2013, several key themes have emerged. This month, we take a look at the importance of being nimble, member engagement and leadership development.

Being Nimble in a Rapidly Changing World

“The only thing that is constant is change.” The world was much different in 500 BC, but Greek philosopher Heraclitus knew what he was talking about. Today, changes appear daily and on many fronts, often at a dizzying pace. To succeed in this environment, an organization must be nimble.

What exactly does that mean? A nimble organization acts on opportunities and threats in time to be relevant. It responds quickly to changing customer (member) needs and creates greater value in doing so.

One aim of the governance proposal is to make ASSE a more nimble organization. The current structure is more than 20 years old. It was created in a different time. This may seem overstated, but consider what the American Psychological Association (APA) discovered during its own governance research:

The cumbersome nature of the current governance process makes it inclusive but not nimble enough to satisfy rapidly communicated needs in a rapidly changing world. APA’s governance model was designed during a more slowly paced time and is reflective of a generation that desired connection to an organization through volunteerism. Current students and early career psychologists have grown up in a time during which social networking is prevalent and immediate answers to their questions are forthcoming, and they expect no less from their professional association. (APA, 2011)

Certainly, APA and ASSE are different in many ways, but it is still easy enough to draw parallels with APA’s findings. It is also important to recognize that nimbleness is more than just acting quickly. It is acting quickly with a purpose. This requires a clear focus on and a universal understanding of the organization’s direction. It also requires volunteer leaders who are focused on strategic thinking and have a finger on the pulse of the industry. These leaders must also have a Society- and profession-wide perspective so they can remain keenly aware of emerging issues that will affect ASSE, the occupational safety and health discipline and its practice in a dynamic global business environment.

Engaging Members, Building Leaders

This raises an important question: Who are the leaders who will help ASSE be nimble and responsive in relevant ways? Filling leadership roles has become increasingly difficult in the 20 years since ASSE last revised its governance structure. Volunteer availability continues to decline as members seek to balance life, work and professional demands. Furthermore, the time required to do the job itself has grown significantly in recent years, yet few employers are willing to support the time commitment required by many of ASSE’s volunteer leadership roles.

Reducing those expectations and spreading the workload among more volunteers is another aim of the proposed governance changes. The long-term expectation is that these changes will lead to a greater number of flexible leadership opportunities that will engage the next generation of leaders and foster their involvement in new ways. It also creates new opportunities for the Society to help members build leadership skills that will enrich their careers while mentoring them as they grow into and embrace their critical roles as representatives of all ASSE members.

Ultimately, it is expected that these greater opportunities for involvement and skill development will improve the overall member experience. By delivering greater value, the Society would be positioned to retain more members and attract new members, both of which are vital to growing ASSE and expanding its influence. Larger membership means a greater voice for the profession, which is key to elevating its practice and providing essential resources and voices to the profession.

Next Steps

The dialogue about this proposal will continue until a motion is brought to the House of Delegates for a vote at some point in the future. Until then, ASSE encourages you to visit the website (www.asse.org/restructure), speak with your local leaders and submit questions and feedback.
PS: At Safety 2013, you led a roundtable on integrating SH&E into green construction. Why are you invested in this topic?

Matt: It is a compelling issue on many levels. The big picture is that green and sustainable products and practices are increasing across many types of industries and settings. At NIOSH, we see an opportunity to promote worker safety and health as a fundamental dimension of true sustainability for all types of jobs. As we said in a 2009 blog piece, “A sustainable product, process or technology should not only protect the environment and consumer but also the worker. Green jobs must be safe jobs” (“Going Green: Safe and Healthy Jobs,” NIOSH Science Blog, July 1, 2009, http://blogs.cdc.gov/niosh-science-blog/2009/07/01/green).

For construction, the built environment is a major focus of green efforts. This is in recognition of the large environmental footprint that buildings have. Reducing the environmental and energy footprint of buildings is taking hold around the world, and it is also driving innovation in building approaches and technologies. According to one survey, momentum is such that green construction is expected to become the norm within several years. As safety and health professionals, we know that construction is one of the more dangerous industries. So the question is: How can we get involved to make sure that green construction is also safer and healthier construction?

Our own interest at NIOSH has been reinforced by stakeholder input. NIOSH supports the National Occupational Research Agenda (NORA), which brings together multiple industry sector stakeholders to identify top problems and develop goals to address them. Based on interest in sustainability, the NORA construction agenda includes a specific goal to utilize green rating systems to implement prevention through design (PTD). And the NORA Construction Sector Council identified integrating safety and health into green construction as one of two topics for special emphasis.

PS: NIOSH has been working on a few initiatives including hosting a workshop to encourage dialogue on green job safety. What are NIOSH’s other projects?

Matt: NIOSH’s PTD program hosted a Making Green Jobs Safe workshop in 2009, and has developed curricula for engineering textbooks and online modules that can also be used in training new engineers. These products include green building examples such as green roofs. In addition, NIOSH is using its Fatality Assessment Control and Evaluation (FACE) program to target fatalities in green jobs to help learn more about potential hazards and risk factors. The FACE program investigates root causes and produces reports that can be used for training and improving investigations.

NIOSH’s Office of Construction Safety and Health has taken the lead in reaching out to the U.S. Green Building Council (USGBC) to build a relationship to better understand how green rating systems work, and to raise awareness about issues of mutual interest. The USGBC Leadership in Energy and Environmental Design (LEED) rating system is the most widely used rating system in the U.S. We worked with the green coordinating group within the NORA Construction Sector Council to perform a credit-by-credit review of the 2009 LEED rating system credits to identify those with positive or negative potential to impact construction and maintenance worker safety and health. We found that seven of the credits had the potential to improve health conditions for construction workers, 11 credits had the potential to cause hazards or exposures to construction workers, and the other 38 credits (about two-thirds of the total) were relatively neutral. We have explored how the credits could be modified to include safety and health, and we have developed draft guidance that could be used to inform green practitioners about safety and health issues related to certain LEED credits.

We are also developing ideas for pilot credits for LEED Version 4 that address safety and health. Green buildings can get innovation credits for trying pilot credits, which provides a mechanism to test and improve ideas so that the appropriate ones can be incorporated into LEED as it evolves and grows. We are also sharing these ideas with various groups to get feedback from the safety and health, and construction communities. We view this as an important foundation for bringing about changes in practice.

PS: What are some challenges of aligning occupational safety and health with green construction?

Matt: The biggest challenge is that SH&E professionals are still not likely to be included during design discussions. Green professionals have made this leap and are included in design—the D in LEED is for design and it is the primary intervention being used to make facilities more sustainable. The problem for construction is that architects own the design process and they have not recognized or embraced the need for including a safety design review into the design and planning process.

Matt Gillen, M.S., CIH, deputy director for NIOSH’s Office of Construction Safety and Health, where he works to coordinate and plan construction research, develop and distribute products, and build relationships between researchers and the construction industry. In addition to his roles at NIOSH, Gillen serves on the NORA Construction Sector Council, the OSHA Advisory Committee for Construction Safety and Health and the ANSI A10 Construction and Demolitions Operations Committee. Gillen has also been involved in various special projects and assignments.
Another challenge is the low profile of operations and maintenance (O&M) hazards and exposures. The initial construction of a building is very visible, involves many workers on site, and is the main focus of most construction safety and health efforts. But studies show that more money is spent operating and maintaining the building than constructing it. For example, a typical office building might need to be reroofed three or four times over its expected lifetime. Yet, these renovation and O&M activities are less visible, involve fewer workers at a time, and seem to get less SH&E attention. So raising awareness about O&M is important.

We have been trying to spread the use of the term life cycle safety to help raise awareness of the tasks performed over the life of a typical building. We define it as the need to comprehensively address building-related occupational safety and health risks for all affected worker groups across all life cycle stages. It has been a helpful way to engage green practitioners as they use life cycle thinking to evaluate environmental and energy considerations.

We have also been discussing the idea of a safe roof plan for buildings with LEED rooftop features, such as vegetated roofs or photovoltaic panels. The idea is that architects need some flexibility for designing the roof, but that they also need to address the issue by including some type of engineering control fall protection features as they consider the design. And the designer needs to hand off information to the building owner prior to occupancy. This should describe the rooftop fall protection features and also describe the LEED feature O&M tasks for which fall protection is needed.

**PS: What increases risk in green practices, and why?**

**Matt:** Based on our discussions with stakeholders and information from available studies, the potential for increased risks is most likely because some of the technologies or practices are new, as opposed to being green. In some cases, the technologies and practices are new to the trades and contractors doing the work. Because there is a tendency among architects, engineers, and green professionals to assume that green practices are safer, they are less likely to request that an SH&E professional be called in to review hazards and exposures. And because it is still uncommon for SH&E professionals to be included in design discussions, we are not there to provide input and precautions. Lastly, when SH&E professionals are not included early when designs and plans are being shaped, it takes them a while to learn about the new green practices. It all adds up to a likely lag time for recognizing hazards and exposures and for developing routine precautions.

SH&E professionals should use their job safety analysis tools to evaluate green practices. They should also ask questions such as, Will green construction cause some trades to experience a new situation? Will it change the sequence of work or the equipment or access? A good resource for construction safety and health practitioners to know about is an online green building safety curriculum developed by the Construction Center of Excellence in Washington State.

**PS: What are some misconceptions associated with green building?**

**Matt:** The biggest misconception is that green construction is inherently safer for workers. Most green building practices focus on occupants of the completed building, not construction or maintenance workers. In addition, most practices focus on health (such as using low volatile organic compound paints and coatings), not safety. Some green practices likely improve conditions for construction worker health, but no green practices directly address safety.

**PS: Can you talk more about the disconnect between green construction and good safety and health practices?**

**Matt:** Occupational safety and health, and environmental safety and health are really sister disciplines with common historical roots and interests. Some organizations and employers have even taken steps to merge the two areas into a single ESH (environmental, safety, and health) or SH&E (safety, health, and environment) department. Yet, separate practice silos are still common. The Las Vegas CityCenter project was the example that first raised questions for many in the construction safety and health community about a potential disconnect between green construction and good safety and health practices. This large, high-visibility project was awarded six Gold LEED certifications in November 2009. The project had a high profile because it was the largest commercial construction project in the U.S. at the time, and it was the subject of a Pulitzer Prize-winning series of safety articles in the Las Vegas Sun focusing on multiple fatalities during its construction. The construction of this large multiple building project involved the same number (six) of construction worker fatalities as the number of LEED certifications.

While there was no indication that the green practices were directly linked to the safety record on the project, this juxtaposition raised questions about an apparent disconnect between good environmental practice and good construction and safety health practice.

**PS: What are some of the new hazards associated with green construction?**

**Matt:** Photovoltaic (PV) solar panels represent an example of a new hazard because, unlike other electrical devices, they cannot be switched off. Construction workers are used to disconnecting electrical equipment before installing or working on it. With a PV panel, the voltage potential is still present until the sun sets or the PV panels are blacked out. So it represents a new type of electrical safety hazard. There is a need for new design and new procedures and training to address this hazard.

What is more common than a new hazard is a new exposure to an old hazard. As an example of an old hazard, such as falls from heights, let’s go back to the roof-mounted PV panels. Installation and maintenance of PV panels on rooftops means more work at height, which increases fall exposures to electricians who may not have much experience working on roofs. Again, there is a need for design and new procedures and training to address this hazard.

**Disclaimer**

The findings and conclusions in this interview have not been formally disseminated by NIOSH and should not be construed to represent any agency determination or policy.
A recent ASSE meeting asked, “What is your leadership succession plan?” After a blank stare from several members I asked: “We don’t have one. What is it, exactly?” “You’re looking at it. I’m all we’ve got.” Safety professionals are not alone. Let me explain succession planning, and provide the five steps to develop a succession planning process.

**Definition**

*Succession planning* can be defined as a process for identifying and developing key leaders within your company. The primary purpose is to increase engagement and retention by providing a career ladder. Some people talk about “bench strength” as if it is a number. How many people do we need to replace the “first string” or senior team in an all-down scenario?

Another purpose of succession planning is to create a talent development culture that affirms individual strengths and develops competencies that drive results. For example, if you need more safety leaders with business development expertise to review proposals, you would promote the best safety leaders on sales calls. Over time, then you would consider including safety leaders with business development expertise to review proposals, and develop competencies that drive results. For example, if you need more safety leaders with business development expertise, you could promote the best safety leaders on sales calls. Over time, you would consider including safety leaders with business development expertise to review proposals, and develop competencies that drive results.

**How to Create a Succession Plan**

Imagine a wheel with five spokes, or a calendar item that alerts you every fifth month, or assigning each of these steps to different people. These are the five steps in an ongoing succession planning process:

1. **Identify** key roles (such as managers and above) that may require replacement in the next 3 years. List each role and each person.
2. **List** the job competencies and personalities for each role that are a) required, and b) recommended. Keep it simple. Lean on your human resources colleagues. Solicit updates from those in the role. We know that the best workers’ compensation people, for example, have a high attention to detail. If uncertain, or if you desire confidential expertise, hire an external vendor.
3. **Assess** your current staff members based on their a) status now (e.g., ready now, development needs defined, development needs to be defined), and b) potential (e.g., skills, ability, longevity, health). Then list concerns for each person such as job performance, health risks, medical needs, family concerns, job potential or ability to travel. Create a database or flow chart.
4. **Identify** a pool of potential talent. Great people are everywhere. Talent scarcity is a myth perpetuated by managers who choose not to invest in their people. Your primary talent pool is internal; your secondary talent pool is external. Hire internally. Internal promotions lead to higher levels of retention and engagement at lower cost. External hires typically cost more and drive conflict (which can be a necessary motivator at any company).
5. **Actively develop** key people using progressions of experiences so that they can be ready now for advancement. Succession planning is not a checklist or software package. It is a series of meaningful experiences. For example, action-learning teams of cross-functional managers may be selected to develop a breakthrough product. High potential managers may be tasked with a business development opportunity or leadership training experience. Senior leaders can be partnered with three or four “HI-POs” (individuals with high potential) for quarterly mentoring sessions. Note that none of these experiences is expensive. For expertise contact any external vendor with experience in succession planning and leadership development experiences. Avoid wasting money on events.

**Review Metrics**

Readers know the value of “What gets measured leads to results” (attributed to Peter Drucker). Know the corollary, “What gets rewarded gets repeated.” There are two parts to that maxim. If reward compensation is not tied to succession planning, then you are wasting time and resources. As a revealing example, one CSP recently told me about a company where employees were tasked with setting up goals on an annual performance review sheet. But they did not need to ever attain those goals. If they completed the sheet they were rated “satisfactory.” The company was measuring the wrong metrics. Good people left. The company wasted time, money, and careers.

A better metric for effective succession development is the percentage of vacancies that are actually filled with internal promotion versus external hire. Your job as a leader is to encourage people to stay in the company. People must believe in your leadership pipeline or career development ladder—pick your metaphor. In fact, at some publicly traded companies, if 45% of the promotions are external hires then it begs questions about the quality of the senior leadership team and the board. You should be developing people, not hiring externally.

**The Bottom Line**

You only have three options for succession planning:

1. Develop succession planning internally.
2. Develop succession planning externally.
3. Ignore the inevitability with a wait-and-see approach.

In reality, you only have the first two choices with 20 or more employees.

A coaching question to leave you with is: How are you identifying and developing your best people?

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Infection Control

The Doctors’ Plague
Germs, Childbed Fever and the Strange Story of Ignac Semmelweis


A good story will trump statistics every time. “She felt lucky in at least this one thing—it was a Sunday. . . .” That is the beginning of a story that piques curiosity. This book could have opened with, “In that year, 1847, one of every six mothers delivered in the First Division of the Allgemeine Krankenhaus was dying of childbed fever.” That would be much less effective as a hook. Nuland knew very well that opening with statistics would not engage readers with his book. Instead Nuland starts with a young girl’s story and finishes with Semmelweis’s story. Now you know the book opens with one tragedy and (I’ll spoil the ending) ends with another. The progression through the death of one girl and her tragedy tells only half of the relevant story for the loss control practitioner. The other half is the failure of Semmelweis’s discovery to be accepted by the contemporary medical profession. Semmelweis’s tragedy was due to his failure to publish his results, combined with some of his own personal peculiarities, accident of birth and funny accent, as well as other “slings and arrows of outrageous fortune.”

The anomaly that cried out for resolution was the fact that the death rate was very different in the two divisions of the delivery sections of the Vienna Allgemeine Krankenhaus. Semmelweis was recognized as a keen and effective observer, even by colleagues who didn’t particularly like him.

Observation No. 1: The same number of deliveries took place in each of the hospital’s two obstetrical divisions, usually between 3,000 and 3,500 per year. The only difference between them was that deliveries in the First Division were carried out by doctors and medical students, and those in the Second Division by midwives and students of midwifery. In the First Division, an average of 600 to 800 mothers died each year from puerperal fever; in the Second Division the figure was usually about 60 deaths, one-tenth as many. (p. 97)

Semmelweis’s achievement was to take facts from his observations and extend his work with a scientific method. He persisted in his observations and confirmed that the doctors and medical students went from dissecting cadavers of those who had died from puerperal fever to examining women in various states of labor without washing their hands. “One of the remarkable phenomena familiar to the entire staff of the First Division was the frequency with which mothers would become sick in rows all at one time” (p. 103). Semmelweis then acted out the next step.

Chloride solutions had long been used to rid objects of the noxious odor of putrid materials. Semmelweis reasoned that a chloride solution would be the ideal substance to destroy the foul-smelling cadaver particles. In the middle of May 1847, he ordered that a bowl of clorina liquida, a dilute concentration of the disinfectant, be placed at the entrance to the First Division, and he insisted that every entering medical attendant wash in it before touching a woman in labor. Small brushes were kept nearby, to be used for cleaning under fingernails. (p. 101)

Change occurred. During the last 7 months of 1847 only 56 women died out of the 1,841 delivered. Soon after, the mortality rate in the doctor’s division had dropped to 3% compared to 1.2% in the midwives division. Even more progress followed. “In 1848, the first full year of the [hand washing] program, the first division had a puerperal death rate of 1.2% and the Second Division of 1.3%, virtually equal” (p. 101).

Despite demonstrated progress at this point, a convergence of unsettlements started that can only occur when relative youth, scientific insights and anecdotes, common examples of failure and recovery methods, Clark educates readers on how to identify and recover from failure to foster future success. Visit www.asse.org/psextra to read full article.
innovation face authoritarian vested interest complicated by mistakes made by the innovator. The science was sound. The investigator became part of the problem. The revelation that the physician himself was the transmitter of the infection would be an enormous difficulty to overcome in implementing the corrective measure. Nuland reports the agony some physicians experienced in the gradual recognition of that fundamental truth. Semmelweis’s delay in publishing his results in clear understandable German was part of the problem. Established physicians with large reputations and their authority confronting evolving science was another aspect of the delay in accepting an improvement in obstetrical practice.

To be fair to those in authority, Semmelweis was working before the establishment of the germ theory of disease. The discovery of the cause of puerperal fever was inevitable because of the progress in the evolution of medicine at the time. Other doctors in other locations in Europe and America were getting close to the discovery. A young man in Boston, MA, named Oliver Wendell Holmes (the doctor not the Supreme Court justice) was on track in 1843. But the science in Boston was quashed by the senior authority in Philadelphia, PA.

If this book weren’t just a clear example of a scientific method, it is also a pungent and powerful illustration of the quotation attributed to Stalin: “One death is a tragedy, a million deaths is a statistic.” The young girl’s tragedy was lost in the grim darkness of the fatality statistic until Semmelweis turned on the light. Insight and improvement were discovered and lost, and had to be rediscovered.

Even now, implementation of thorough hand washing is still not accomplished. The importance of simple hand washing was found and lost before and just after 1848. It has been rediscovered. But in 2013, nosocomial infection is still a hospital problem and hand washing or hand sanitizing with chemicals is a long way from 100%. Semmelweis’s observation, analysis and solution of a particular infection problem propels us forward to the general challenge of hand washing and nosocomial infection. Today, hand hygiene in hospitals has less than ideal adherence. It is said to vary between 26% and 86% depending on which study and which hospital is cited. Hospitals and healthcare professionals are concentrating on the challenge.

Oddly enough, the current state of affairs is reflected in one physician’s quip: “You can sit on any toilet seat in America. Just don’t shake your doctor’s hand.” Nuland’s detailed use of narrative and just enough statistical exposition tells two stories and exposes the contentious relationship between authority and institutional inertia as it confronts progressive science, innovation and insight. Loss control professionals can empathize with Semmelweis’s difficulties.

Carl Metzgar, CSP, ARM
Winston-Salem, NC
PS: Talk a little about OHSAS 18001 and occupational safety and health management standards in general. 
Denise: It doesn’t matter if you use Z10, the Canadian Z1000 or OHSAS 18001; they are all important and have the same intent of control. I don’t think they necessarily work well for small organizations; I think they are a little bureaucratic for small organizations. But, if you have an organization of 75 or 100 people, at that size, it is more difficult to keep everybody on the same page, so having a formalized safety management approach using one of those standards is effective.

PS: Would you recommend OHSAS 18001 to organizations in all industries? 
Denise: I haven’t seen a single industry in which it doesn’t work so far. I have even seen office environments that have improved through use of the standard. The standard takes a consistent approach. No matter where you are, people tend to become too relaxed when doing their jobs. Because they perform their jobs all the time, they become oblivious of any public safety issues in relation to what they are doing and that is when you get in trouble. Having a system, and the monitoring activities associated with it, is critical to maintaining overall control.

PS: How does OHSAS 18001 compare to ANSI Z10? 
Denise: ANSI Z10 is written from the perspective of a national standard, and when you look at it from that perspective, it is aligned more closely with regulations to the point where it can be described as prescriptive. When looking at OHSAS 18001, for example, it states that you have to meet applicable legal and regulatory requirements. It doesn’t go into any detail and it is very generic. It is only as good as the people who are actually auditing the standards who have to know and understand what the regulatory requirements are.

One thing that Z10 does that OHSAS 18001 does not is it has the split-screen approach, where you have one column with requirements and the other column with guidance documents. It is quite user friendly. Regardless of which standard you pick, as long as you use a safety management approach, you will see results.

PS: What common challenges do organizations experience when implementing OHSAS 18001? What can be done to make implementation a smoother process? 
Denise: The number one problem is people. When new things are introduced, a percentage of people will not buy it no matter what you do, and another percentage of people immediately jump on board and want to lead the way and challenge what they like. Then, you have those who say they will do it, but they have to relearn their processes. I think that is probably the biggest challenge in every organization.

The next challenge is with the management team. Many managers are so focused on getting the product out the door that when they decide to create programs like this, they throw it over the wall at the safety professional and expect it to be done. These management standards are just that; they are management standards and they need to be managed.
the input, the involvement and the commitment of all levels of the organization. It is difficult to achieve that when we are focused on getting the product out the door.

The third real problem is changing behavior. Anybody in the safety arena has been aware of that for a long time. Behavioral change is the key to fixing problems and it does not come easily to most.

**PS: Why should safety professionals use a safety management system standard?**

**Denise:** The use of a safety and health management system standard is critical in that the cost of safety and health is as important to the bottom line as making and selling products. The people doing the job are a valuable resource and protecting them against injuries to ensure that they can continue to do their jobs is critical. From a social aspect, of course, people are what life’s all about, and protecting them is critical.

Standards have become a way of life so that we can predict the outcome of the work that we do and get the results that we hope for. The bottom line is that we need to get everybody marching forward in the right direction to get the results we want.

**PS: Is there anything else that you would like to share?**

**Denise:** With OSHA considering revamping its programs—and again, OSHA is focusing on a management approach—I think Z10, Z1000 and OHSAS 18001 put a lot of tools in place to help organizations implement safety management and get it under control. Anyone who chooses to implement a management system has to expect it will take between 12 and 24 months to put everything in place, then an additional 18 months before actual and concrete results can be seen because that is how long behavioral changes usually take.

Management standards are going to be the focus of OSHA regulation as the agency reworks the regulations. Everyone must be aware of that and understand that since it takes a long time to implement, they should get on board now.
HazMat Emergencies

Decontamination & Victim Chain of Survival

By Scott Gunderson, Cameron Helikson & Michael Heffner

Consider the following hypothetical scenarios of workplace emergency decontamination incidents involving hazardous materials:

A pressurized hose recirculating potassium gold cyanide into a clean room electroplating bath breaks loose from the clamps holding it against the bath wall. The hose whips around and sprays the corrosive liquid onto a nearby employee. She hits the emergency “off” button, and as the chaos quiets, she and her coworkers realize she is standing in a puddle of plating solution, with the liquid dripping from her cleanroom clothing. Her first impulse is to go change her clothes in the locker room, but her supervisor orders her to an enclosed emergency shower stall with a drain. She walks from the puddle to the shower, trailing a path of wet footprints.

At another company, an employee loses his hold of a heavy product and drops it into an acid etching tank. The full-front apron, gloves, face shield and goggles protect him from the splashing acid. But, his coworker who has his back turned feels the acid splash on his back, buttocks and legs at the gaps between his apron ties. He pulls the handle of the emergency shower, an open unit against the wall, and removes his clothing as acid and rinse water cascade across the floor.

Workplace HazMat emergency response is well-defined in standards and regulations such as HazWOPER, and workplace medical emergency response is equally well-defined in practices such as first aid. However, combining the two is complicated because the urgency of first-aid response tends to collide with the systematic and planned sequences of HazWOPER. This article addresses issues around HazMat emergencies with employee exposure, and focuses on safe and effective emergency decontamination of HazMat victims in occupational settings such as manufacturing, warehousing and laboratories (see “Maximizing HazMat Victim Care”).

The authors have excluded transportation emergencies, nonoccupational exposures, and criminal, combat or terrorism events due to the broad nature of these subjects and their integration with issues such as traffic control, security and tactical operations. Transportation involves potential exposure to the nonoccupational general public, and in the case of highway incidents, the absence of readily available emergency decontamination facilit-

IN BRIEF

• HazMat emergencies represent a significant response challenge, especially when employees are exposed and the response involves a victim.
• A growing body of literature and standards guides emergency medical services (EMS) and hospital professionals in HazMat victim response and treatment. But, the SH&E professional must navigate separate standards: HazWOPER for HazMat emergencies and standard first aid for HazMat victim response.
• What strengths each standard may have in isolation are lacking when coupled with each other or as explicit preparation for the more advanced response that follows when EMS arrives.
• The authors review these standards and integrate several key concepts for effective response to HazMat victim emergencies in the workplace to make the most of the critical time between employee exposure and EMS arrival.

Scott Gunderson, CSP, CHMM, is a safety compliance officer at Oregon OSHA, with prior workplace emergency response experience in various industries including semiconductor manufacturing and chemical processing. He has published articles in Professional Safety, Systems Engineering and Journal of System Safety. Gunderson holds a B.A. from Western Oregon University and an M.A. and M.Eng. from Portland State University. He is an Oregon emergency medical technician (EMT), an American Heart Association Basic Life Support instructor and a professional member of ASSE’s Columbia-Willamette Chapter.

Cameron Helikson is the environment, health and safety (EHS) manager at Tosoh Quartz Inc. in Portland, OR. He has been in EHS for 14 years and has specialized in developing emergency response teams and in using technology in EHS. Helikson is an Oregon-licensed EMT-Intermediate and has been a volunteer with the Newberg Fire Department for 19 years. He is an American Heart Association BLS instructor and is a certified in HazMat technician (40-hour), advanced cardiac life support, advanced medical life support and prehospital trauma life support. He holds a B.S. in Business from Portland State University, and has been published in Professional Safety. Helikson is a professional member of ASSE’s Columbia-Willamette Chapter.

Michael Heffner, B.S., EMT-P, is a captain with the City of Salem Fire Department where he is assigned to one of Oregon’s 13 regional HazMat response teams. He is an Oregon-licensed paramedic and a certified HazMat technician. Heffner teaches emergency medical care, HazMat response and hospital first receiver classes throughout Oregon. He holds a B.S. from Portland State University and Eastern Oregon University.
ties such as emergency showers. Additionally, law enforcement, military or other potential mass casualty emergencies, such as terrorist attacks with chemical weapons, involve even more issues, such as significant public exposure, potentially long periods with unidentified contaminants and ongoing tactical threats (e.g., active shooter and secondary explosives) timed for arrival of emergency responders.

Magnitude of Problem
Agency for Toxic Substances and Disease Registry (ATSDR, 2009) surveyed data from 13 states in the first half of 2009, cataloging 3,458 HazMat emergencies. These emergencies involved 1,050 victims, of whom 44 died. Of these emergencies, 68% were in fixed facilities, with manufacturing representing the highest number (27%). Of the victims, 91% were in fixed facilities, with employees representing the highest number of victims (44%). In the second half of 2009, six states reported 1,352 HazMat emergencies with 319 victims and 8 fatalities. Like the first half of the year, fixed facilities and manufacturing represented the highest (99% and 27%, respectively). These fixed facilities again reported the highest number of victims (83%), with employees representing 10% (ATSDR, 2009).

Decontamination
Decontamination practices have evolved since the NFPA 472 standard was created and replaced NFPA 471, which spent much of its decontamination section on standardized procedures for controlled entry and exit through an established corridor linking the operational areas of the hot zone (e.g., exclusion or contamination area), warm zone (e.g., transition or contamination reduction area) and cold zone (e.g., support or clean area). Although this separation of operational areas is ideal in principal, NFPA 472 acknowledges the more realistic potential for chaos as emergency responders arrive, with five categories of decontamination.

1) Emergency decontamination. “The physical process of immediately reducing contamination of individuals in potentially life-threatening situations with or without the formal establishment of a decontamination corridor” (NFPA, 2008b). This is what workplace emergency responders perform when they assist an employee in an emergency shower until emergency medical service (EMS) personnel arrive, and it is the primary focus of this article.

2) Gross decontamination. This may be an initial part of emergency decontamination of victims, or the first step in technical decontamination of responders exiting the hot zone through a supervised decontamination corridor. In both cases, as high a percentage as feasible of contamination is rinsed off prior to further decontamination.

3) Mass decontamination. “The physical process of reducing or removing surface contaminants from large numbers of victims in potentially life-threatening situations in the fastest time possible” (NFPA, 2008b). This may be an emergency decontamination or a gross decontamination, and simply describes the fact that more than one person undergoes decontamination. Although typically performed by EMS personnel, the authors are aware of two separate workplace incidents with two exposed employees each, forcing them to each walk to separate emergency showers; in one incident, SH&E professionals can do much to establish safe and effective HazMat victim response and strong links in the response chain between workplace responders and emergency medical services (EMS). Prevention remains the best strategy, and design for safety and training for safe operation is paramount, but a solid emergency response program should at a minimum include the following:

- **Hardware.** Functioning and appropriately located emergency eyewash and shower systems, PPE for employees and workplace responders, first-aid supplies and response supplies such as absorbents on reserve and dedicated for emergency-only use. All hardware must be inspected regularly, maintained and tested periodically.

- **Information.** Safety data sheets and a site-specific emergency response plan at a minimum, ideally including HazMat-specific procedures for highly hazardous materials such as hydrofluoric acid that require rapid response.

- **Internal communications.** HazMat victims must be able to summon assistance and workplace responders must be able to gather team members. Depending on operation size and complexity, internal communications can be as simple as verbally shouting across the room, using handheld radios or public address systems, or emergency shower flow alarms connected to central alarm systems with security personnel on staff able to monitor and notify workplace responders.

- **External communications.** Typically 9-1-1 in the U.S. If site telephones require dialing a special number for an outside line, then this must be included in employee training. Caller identification may or may not be present at the 9-1-1 call center, and the physical address must be either known by employees or posted in visible locations in the workplace so that it can be communicated to the dispatcher.

- **Coordinating with EMS upon arrival.** Workplace emergency responders must greet EMS upon arrival, direct them to the specific location of the emergency and rapidly provide accurate information about the emergency. Emergency locations may be far removed from typical entry points such as front gates, front doors or shipping bays. Additionally, fire and ambulance services may arrive separately, and the greet-direct-communicate sequence may need to be repeated.

- **Training.** Workplace emergency responders must know these procedures, the proper use of their resources and effective communication to EMS during an emergency. Workplace emergency responders must also understand the role of EMS and how workplace responders and EMS can best work together on site.
the spill size in the facility was doubled with drops and wet footprints from the emergency scene to the two showers.

4) Technical decontamination. This may describe either the controlled decontamination of responders leaving through the decontamination corridor (NFPA, 2008a), or thorough decontamination of HazMat victims for emergency medical treatment on site and/or prior to releasing for transportation and further treatment (NFPA, 2008b). Technical decontamination of HazMat victims typically involves significantly more surface rinsing than occurs in a workplace emergency shower, and may involve use of brushes, cleaning agents such as soaps and detergents, and, depending on the protocols of the responding agency, irrigation and/or suction of nasal and oral cavities as needed. The transition from emergency decontamination of HazMat victims by workplace emergency responders to technical decontamination by EMS personnel is discussed in more detail.

5) Definitive decontamination. This is performed in the hospital as part of treatment, and it is outside the scope of this article, as well as outside the scope of NFPA 472 and NFPA 473.

Table 1 summarizes typical roles, responsibilities and expectations for each level of decontamination from workplace emergency responders to EMS personnel and, finally, to hospital personnel.

HazMat Victim Care

The following sections describe HazMat victim care in reverse chronological order to provide context for the final section on emergency decontamination by workplace emergency responders. The authors believe that workplace emergency responders perform better if they understand the expectations and actions of the higher-level responders with whom they will interact.

Table 1
HazMat Emergency & Victim Decontamination Responsibilities

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Role</th>
<th>Expected levels of contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workplace emergency responders</td>
<td>Initial response; notify EMS; emergency decontamination</td>
<td>High, both scene and victim(s)</td>
</tr>
<tr>
<td>Emergency medical services (EMS) personnel</td>
<td>Arrive at scene; assume control of response; emergency, mass, gross and/or technical decontamination; emergency medical treatment; transport victim(s)</td>
<td>High, transitioning to as low as possible for victim(s)</td>
</tr>
<tr>
<td>Hospital personnel</td>
<td>Receive victim(s); definitive decontamination and treatment</td>
<td>Low, with exception of self-transported “walking wounded”; emergency and technical decontamination capabilities but preference for receipt of decontaminated victim(s)</td>
</tr>
</tbody>
</table>

Table 2
Summary of NFPA 473 Patient Priority Levels

<table>
<thead>
<tr>
<th>Contamination level</th>
<th>Medically critical</th>
<th>Medically unstable</th>
<th>Medically stable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy contamination;</td>
<td>Combined priorities</td>
<td>Decontaminate first</td>
<td>Decontaminate first</td>
</tr>
<tr>
<td>highly toxic substance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy contamination;</td>
<td>Medical care first</td>
<td>Combined priorities</td>
<td>Combined priorities</td>
</tr>
<tr>
<td>low-toxicity substance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low contamination;</td>
<td>Combined priorities</td>
<td>Decontaminate first</td>
<td>Decontaminate first</td>
</tr>
<tr>
<td>highly toxic substance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low contamination;</td>
<td>Medical care first</td>
<td>Medical care first</td>
<td>Combined priorities</td>
</tr>
<tr>
<td>low-toxicity substance</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. “Summary of NFPA 473 patient priority levels for immediate decontamination, immediate medical care or combined priorities. Medically critical is defined as compromised airway, serious shock, cardiac arrest and/or life-threatening trauma or burns. Medically unstable is defined as shortness of breath, unstable vital signs, altered levels of consciousness and/or significant trauma or burns. Medically stable is defined as stable vital signs, no altered level of consciousness and/or no significant trauma or burns. Adapted from Table A.5.4.2, NFPA 473, Standard for Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents, by NFPA, 2008, Quincy, MA: NFPA.”
physician review of victims as a standard conclusion in their protocols for HazMat exposures. It is rare for a HazMat victim emergency to end with EMS personnel not transporting the victim for further evaluation and care.

One critical issue for the hospital is secondary contamination, which occurs when hospital personnel, other patients and property are exposed to hazardous materials due to improper decontamination of victims transported to the facility. Where EMS personnel are designated as first responders with high levels of HazMat response training, hospital personnel are typically designated as first receivers, potentially with less training in emergency decontamination, due to the assumption that EMS personnel will perform proper decontamination prior to transportation (OSHA, 2005; 2008b).

Strong communication between EMS and hospital personnel, as well as good technical decontamination practices in the field, can prevent secondary contamination (Horton, Berkowitz & Kaye, 2003). NFPA 473 strongly emphasizes HazMat victim decontamination as soon as possible and certainly prior to transportation: “It is unwise to accept a contaminated patient into a transport unit or to be unsure of the level of decontamination performed. A poor decision in the field can have significant ramifications at the door of the hospital” (Trebisacci, 2008, p. 485).

**Emergency Medical Services**

Horrific case studies of ambulance contamination following a fatal exposure to hydrofluoric acid and an emergency department shutdown following the arrival of a pesticide-contaminated patient illustrate the reasons why healthcare professionals emphasize early and thorough victim decontamination (Vogt & Sorensen, 2002). Contamination to personnel and hardware is a real threat to everyone in the emergency response chain; this threat is key to EMS personnel balancing responder safety and victim care.

NFPA 472 and 473, as well as other sources, give priority to EMS personnel safety (NAEMT & American College of Surgeons Committee on Trauma, 2007; OSHA, 2009). EMS personnel perform an initial scene size-up for arrival on their own safety and to prevent increasing the magnitude of the emergency by having responders become additional victims. The actions and communications of workplace emergency responders before and during EMS arrival can either facilitate a smooth transition or cause delays as EMS personnel review the scene for their own protection.

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency of workplace emergency responders</td>
<td>Effective training</td>
</tr>
<tr>
<td>Understanding by workplace emergency responders of EMS procedures</td>
<td>Effective training, emergency preplanning meetings with EMS, joint exercises with EMS</td>
</tr>
<tr>
<td>EMS familiarity of site and trust in workplace emergency responder competency</td>
<td>Site tours, emergency preplanning with site representatives, joint exercises with workplace emergency responders, workplace emergency responders provide site emergency response procedures and other information (e.g., floor plans, SDS, etc.) to EMS upon arrival</td>
</tr>
<tr>
<td>Delayed or incomplete scene size-up by EMS upon arrival</td>
<td>Workplace emergency responders mark safe vs. hazardous areas prior to EMS arrival</td>
</tr>
<tr>
<td>Delayed or incomplete first impression by EMS of HAZMAT victim upon arrival</td>
<td>Workplace emergency responders have critical information ready for transfer to EMS prior to EMS arrival (e.g., incident summary, SDS, time HazMat victim in emergency shower, etc.)</td>
</tr>
</tbody>
</table>
Table 4
Standards Related to HazMat Emergencies & HazMat Victim Response

<table>
<thead>
<tr>
<th>Standard</th>
<th>Target audience</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard Communication OSHA 1910.1200</td>
<td>All workplace employees</td>
<td>Basic training requirements on safe use as well as emergency response to hazardous materials in the workplace</td>
</tr>
<tr>
<td>Emergency Action Plan OSHA 1910.38</td>
<td>All workplace employees</td>
<td>Basic emergency requirements (e.g., notification, evacuation)</td>
</tr>
<tr>
<td>Medical and First Aid OSHA 1910.151</td>
<td>Workplace emergency responders</td>
<td>Requirements for first-aid supplies, first-aid training and emergency eyewash/showers (see also ASTM 2009 and ANSI 2009)</td>
</tr>
<tr>
<td>Hazardous Waste Operations and Emergency Response OSHA 1910.120</td>
<td>Workplace emergency responders</td>
<td>Detailed requirements for HazMat emergency response, including long-term cleanup of contaminated sites</td>
</tr>
<tr>
<td>Contingency Plan and Emergency Procedures EPA 262 Subpart D</td>
<td>Workplace emergency responders</td>
<td>Detailed requirements specific to hazardous waste, including documentation of plans and advanced communications with local authorities (e.g., fire, EMS)</td>
</tr>
<tr>
<td>NFPA 471</td>
<td>Workplace and public emergency responders</td>
<td>Competencies for HazMat emergency responders</td>
</tr>
<tr>
<td>NFPA 472</td>
<td>Emergency medical service (EMS) personnel</td>
<td>Competencies for EMS personnel responding to HazMat incidents, with emphasis on HazMat victim care at emergency site and during transportation to hospital</td>
</tr>
</tbody>
</table>

The authors have witnessed EMS personnel refuse to enter HazMat emergency scenes because they were not confident about the accuracy of information from workplace emergency responders, resulting in delayed medical care to HazMat victims.

Once confident that they can safely respond, EMS personnel will assume control of the scene for entry and response, including victim care. For HazMat victim emergencies, Table 2 (p. 42) summarizes the priorities for immediate decontamination, immediate medical care or combined priorities.

Workplace emergency responders can either facilitate or delay EMS response. The authors believe that early attention to proper emergency decontamination and accurate information will permit EMS personnel to more quickly begin medical care for victims. Additionally, preplanning, including tours and training drills, between site and EMS representatives can improve EMS knowledge of the site, its hazards and the capabilities of the workplace responders. This builds working relationships, and improves communications and efficiency during the critical transition between workplace responder and EMS control of emergency operations (Table 3, p. 43).

Workplace Emergency Response

The HazWOPER standard is the cornerstone of most workplace HazMat emergency response plans (OSHA, 2008a). The advanced planning and education of employees required by this standard contributes to emergency prevention and response, and it is the knowledge of facility employees who work with hazardous materials that can help prevent secondary contamination in the EMS and hospital systems (Berkowitz, Horton & Kaye, 2004). While the HazWOPER standard thoroughly covers HazMat scene safety and directs attention to issues such as spill response and recovery, its coverage of emergency decontamination and HazMat victim care is limited, even though the standard contains provisions that require planning for medical monitoring and first aid.

Where HazWOPER lacks specifics on emergency decontamination and HazMat victim care, standard first aid and other emergency decontamination references provide few details on these subjects and typically exclude reference to site control and the wider response. First-aid training courses

Photo 3: Technical decontamination of victim (training exercise with manikin). EMS responders have removed and contained the victim’s clothing and jewelry to significantly reduce external contamination. Next, EMS responders will systematically rinse, wash and re-rinse both the front and back side of a victim before preparing him/her for ambulance transport to the appropriate receiving hospital.

Photo 4: Definitive decontamination of victim (training exercise with manikin). Hospital first receivers in Level C PPE provide definitive decontamination of a HazMat victim before admission into the facility to avoid secondary contamination of hospital personnel, other patients and equipment.
emphasize emergency decontamination as the primary action for HazMat exposure: remove the contaminants from the victim as soon as possible (Markenson, Ferguson, Chameides, et al., 2010; Koenig, 2003).

Many SH&E professionals are familiar with boil-er plate language in the typical safety data sheet, advising 15-minute eye and skin flushing and medical care if employees are exposed. Although general in their language, the authors agree with the references and standards for workplace first aid and emergency eyewash and shower equipment that recommend site- and substance-specific emergency training for employees, hazard-specific procedures and hazard-specific response hardware (ANSI, 2009; ASTM, 2009; OSHA, 2006). Table 4 summarizes relationships among these various standards related to HazMat emergencies and victim response.

Cardiac Chain of Survival

While individually strong, numerous HazMat emergency and HazMat victim response sources are either silent or only provide hints about how they can work together. The cardiac chain of survival provides a comparison for cardiac emergencies; it is explicit on the connection between victim care and the wider response (Travers, Rea, Bobrow, et al., 2010).

1) early notification to EMS;
2) early CPR;
3) early defibrillation;
4) early advanced emergency medical care.

HazMat Victim Chain of Survival

If the workplace emergency and victim response standards suffer in isolation, then a HazMat victim chain of survival, similar to the established cardiac chain of survival, provides a conceptual framework for bridging these critical emergency response steps:

1) Early notification to EMS: Every second delayed before calling EMS (e.g., 9-1-1 in most U.S. locations) results in delayed dispatch and arrival. As with cardiac and other medical emergencies, workplace responders to HazMat victim emergencies can fall into tunnel vision performing immediate response activities. Early notification allows site responders to get EMS en route before proceeding to more complicated tasks such as establishing hot, warm and cold operational zones.

2) Early emergency decontamination: Every delayed second starting emergency decontamination allows hazardous materials to injure exposed employees by burning, absorption or inhalation. The span between these first and second steps should be as short as possible, and preferably done simultaneously by multiple employees and/or workplace emergency response team members.

3) Early scene control and HazMat characterization: Uncontrolled scenes can permit unauthorized entry and potential exposure to other employees. Gaps in information or communication lapses can delay immediately required response actions such as topical application of calcium gluconate for hydrofluoric acid exposure, topical application of polyethylene glycol for phenol exposure, administration of hydrogen cyanide antidote or other applicable treatments.

4) Accurate communication to EMS: Gaps in information, if unresolved on EMS arrival, can cause further delays in technical decontamination, medical stabilization, ambulance transportation, definitive decontamination and treatment.

Like the cardiac chain of survival, the HazMat victim chain of survival is relatively simple, facilitating training and retention for workplace emergency responders. The concepts easily work their way into a performance support tool (Figure 1), which can be added to site emergency response hardware (e.g., spill equipment storage units, first-aid kits) mounted at walls near emergency eyewash and shower equipment.
Conclusion
Consider this concluding example:
A nonroutine task with inadequate energy iso-
lation results in a pressurized chemical pipe
spraying liquid onto an employee. He screams
and staggers into an emergency shower as
others close the valve. His colleagues refer to
a checklist posted outside the shower, begin
to page site emergency responders and call
9-1-1. The supervisor directs one employee to
print the safety data sheet, another employee to
mark the floor contamination with traffic cones
cautions tape, and another employee to
go to the primary entrance to direct EMS per-
sonnel to the emergency scene. The supervi-
sor and other employees tell the victim to
stay in the shower and that EMS is on the way.
When EMS personnel arrive, they drive to the
employee waving at the primary entrance. In-
side, the supervisor briefs EMS personnel on
the emergency and the hazardous material in-
volved, points out the marked spill zone and
hands them the safety data sheet. Aware of the
hazards, the hazardous area and the amount
time the victim has been in the shower, EMS
personnel begin their response in an environ-
mant of rapid emergency decontamination and
clearly communicated information promot-
ing responder safety and prompt victim care.

Workplace emergency responders who complete
such a performance support tool, have all the ele-
ments in place for rapid notification to internal
and external responders, rapid emergency decontami-
nation of HazMat victims and accurate information
to arriving EMS personnel who can proceed to vic-
tim care with fewer delays for self-protective scene
evaluation. PS

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Disclaimer
The opinions in this article are those of the
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Oregon OSHA or any affiliated agency.
Millions of U.S. workers are at risk for a work-related motor vehicle crash. Fatality data show that across all industries, motor vehicle crashes are consistently the leading cause of work-related fatalities. Of 43,025 work-related fatalities reported by BLS 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. During the same period, an additional 2,487 workers died in crashes that occurred off a public roadway or on industrial premises (BLS, 2013).

An analysis of the costs of motor vehicle crashes to U.S. employers using data from 1998 to 2000 found that on average each fatality cost a business more than $500,000 in direct and liability costs, and that each nonfatal injury costs nearly $74,000 (National Highway Traffic Safety Administration, 2003). More recently, workers’ compensation costs for motor vehicle crash-related injuries requiring more than 6 days away from work were estimated to be nearly $2 billion (Liberty Mutual Research Institute for Safety, 2012).

The risk of work-related motor vehicle crashes 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 vehicle crashes 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, 2011). Heavy and tractor-trailer truck drivers account for the highest proportion of fatalities in any single occupation: 39% of the total for 2003 to 2010 (BLS, 2013).

ANSI/ASSE Z15.1: History & Scope
The ANSI/ASSE Z15 Accredited Standards Committee (ASC) was organized in 2001 to create a consensus standard with requirements for policies, procedures and management processes that organizations can use as a tool for auditing an existing program.

IN BRIEF
- The risk of work-related motor vehicle crashes 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 vehicle crashes while driving or riding in a motor vehicle on a public roadway.
- ANSI/ASSE Z15.1-2012 provides comprehensive guidance on fleet safety program elements and can be used as a tool for auditing an existing program.
can implement to control risks associated with motor vehicles (ANSI/ASSE, 2012).

First published in 2006, ANSI/ASSE Z15.1, Safe Practices for Motor Vehicle Operations, sets forth practices for the safe operation of 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 a template for developing policies, procedures and processes to better manage the risks associated with vehicle use. The standard is applicable to organizations whose vehicles and drivers are covered by Federal Motor Carrier Safety Regulations (FMCSRs; “regulated” fleets), as well as to organizations whose vehicles and drivers do not operate under the FMCSRs (“nonregulated” fleets).

For an organization seeking to formalize its vehicle operations safety program, Z15.1 provides comprehensive guidance on program elements, but leaves it up to the organization to design the specific detail based on its unique circumstances. For an organization with a mature program, a fleet manager can use the standard to audit the existing program or provide a risk-based approach to fleet management.

The field of vehicle risk management has evolved in recent years. The 2012 version of Z15.1 includes more guidance in several areas (e.g., distracted driving) than the 2006 version. Furthermore, the standard provides suggestions for measuring performance over time.

The standard contains 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 is divided into two columns. 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 nonmandatory guidance and interpretation of the corresponding material in the left column. Several appendices provide valuable supporting information and tools to help an organization apply the standard.

ANSI/ASSE Z15.1-2012 & Nonregulated Fleets: One Company’s Experience

ANSI/ASSE Z15.1 was intended to be applicable to both regulated and nonregulated fleets. This example shares one company’s experience in implementing the standard for its nonregulated fleet.

Baxter Healthcare has approximately 1,000 U.S. employees who drive regularly on business. Most of these employees are part of the sales force and are considered nonregulated fleet drivers. In December 2008, the company’s corporate SH&E audit team engaged an external fleet-safety expert and facilitated the first SH&E-focused audit for its U.S. nonregulated fleet.

The goal was to understand how the company managed its nonregulated fleet and, more importantly, fleet risk. Managing fleet risk goes beyond the vehicle itself and encompasses effective management of drivers and driving behaviors.

The audit revealed strong management of fleet operations, vehicle selection and acquisition, as well as opportunities to improve a risk-based approach to managing fleet risk. The audit encompassed interviews and an assessment of various areas including:

- current process for managing fleet;
- identification of key stakeholders;
- types and number of vehicles;
- vehicle selection and acquisition;
- 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.

In early 2009, the corporate SH&E manager and U.S. fleet manager formed a strong partnership. They developed a strategy and tactical plans, as well as an action timeline, to close gaps identified during the fleet audit and to strengthen management of nonregulated fleet risk. Baxter’s fleet manager led the effort and the SH&E manager leveraged a transitional leadership/partnership style to provide guidance, expertise and support. The fleet manager also engaged key stakeholders to support development and deployment of a tailored approach.

The company referenced ANSI/ASSE Z15.1-2006 to develop a best-in-class approach to managing fleet risk. Because policies and procedures are the foundation of a nonregulated fleet program, the company strengthened its overall driver policy. In addition, Baxter developed and deployed a nonregulated fleet safety program and specific guidelines to cover aspects such as authorized driver requirements, safe vehicle use and expected maintenance. The Z15.1 standard provided the framework for the policy and guide, tailored to fit Baxter. Measurement systems were also enhanced, leveraging concepts from the standard.

ANSI/ASSE Z15.1 & Commercial Fleets

Unlike noncommercial fleets, commercial motor vehicle fleets are 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. When it first promulgated the standard in 2006, the Z15 ASC theorized that since commercial motor fleets were heavily regulated, FMCSA and its FMCSRs would ensure that commercial operators had the required safety structure in place (although parts of Z15 apply to commercial operations).

However, 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 (FMCSA, 2012). 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 (FMCSA, 2012).

**Limitations of the FMCSRs**

The FMCSRs contain detailed requirements for specific concerns such as hours of service (HOS) (49 CFR Part 395), but say little about the basic policies and procedures that are the foundation of a workplace safety program. The only required written procedures/policies 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 regulations contain no requirements for a written crash/incident review policy, discipline procedure, driver hiring/orientation, and training in vehicle operation and inspection.

The regulations include 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, HOS training, truck inspection training, or annual drug and alcohol training (although some initial training is required).

In the past, FMCSA rarely interacted with commercial fleets, with the exception of compliance reviews. This review is a full-blown audit that results in a rating of satisfactory, conditional or unsatisfactory. Fines can result, and an unsatisfactory rating could cause the motor carrier to be shut down. FMCSA also conducted safety reviews, typically 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 agency, and the number of drivers and carriers was far greater than the number of compliance reviews performed each year (FMCSA, 2013).

**The CSA Model**

In 2010, FMCSA introduced the Compliance, Safety, Accountability (CSA) program (FMCSA, CSA). Its goal is to significantly reduce the number of large truck crashes and make this segment of highway transportation safer (Figure 1). The first phase of the CSA model is measurement. Violations are grouped into seven categories of similar violations, referred to as BASICS (behavioral analysis and safety improvement categories): 1) unsafe driving; 2) HOS compliance; 3) driver fitness; 4) controlled substances/alcohol; 5) vehicle maintenance; 6) HazMat compliance; 7) crash indicator.

These categories are assigned weights as to the probability of causing a crash. Since development of the original model, FMCSA has made several changes: fatigue is now HOS; the cargo category is now a dedicated hazardous materials category; and load securement violations are now in the maintenance BASIC.

The middle phase of the model, intervention, makes ANSI/ASSE Z15.1 directly relevant to commercial fleets. FMCSA envisioned a broader array of intervention tools that would be applied directly or in a progressive fashion to motivate fleet operators to be more proactive in their safety efforts. These intervention tools include:

- Early contact
  - warning letter;
  - access to safety data and measurement;
  - targeted roadside inspection.
- Investigation
  - off site;
  - on-site (focused);
  - on-site (comprehensive).
- Follow-on
  - cooperative safety plan;
  - notice of violation;
  - notice of claim;
  - operations out-of-service order (FMCSA, Intervention).

**Figure 1**

Original CSA Operational Model

Six safety management processes are the backbone of the safety management cycle: 1) policies and procedures; 2) roles and responsibilities; 3) qualification and hiring; 4) training and communication; 5) monitoring and tracking; and 6) meaningful action.

**FMCSA Safety Interventions Under CSA**

Under CSA, FMCSA is seeking more interactions with carriers that have problems as indicated by the safety measurement system (SMS), but the agency wants to use methods that are less intensive than traditional compliance reviews. One early contact intervention, warning letters (which are generated based on SMS scores), has drawn much attention from commercial fleet owners. For example, Nationwide’s regular customer service outreach includes a DOT compliance class that covers FMCSRs for motor carriers. Invitations were sent to a large number of carriers, but only a small percentage attended, unless they had recently received a warning letter.

Another 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 example, if the scores indicate that a carrier has HOS problems, agency investigators may visit a carrier’s main office, review HOS logs and take action based on the findings. In such a case, the investigators will likely review only HOS records, not other safety-related documents such as maintenance records or driver qualification files. This approach allows agency personnel to have contact with more carriers and to focus only on identified problem areas. The rationale is that more contact or increased potential for contact will prompt carriers to pay more attention to SMS scores and to make improvements in order to avoid fines.

The cooperative safety plan is a follow-on intervention under CSA. In some ways, it addresses a shortcoming of FMCSA’s approach: the lack of a model that allows the agency to work more cooperatively with carriers to reduce violations and improve performance. After intervening at a company, the agency may agree to withhold a notice of violation if the company can devise corrective action. FMCSA then either agrees or disagrees that the proposed actions represent a good-faith effort, and monitors progress.

This is where the gap in the federal regulations 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 a carrier will follow the cooperative safety plan in the absence of the policies and procedures needed for implementation and the documented training to show commitment and improvement. The answer is simple. To participate, a carrier must submit a written cooperative safety plan to FMCSA. Such a plan will need to be supported by a policies and procedures manual. Using Z15.1 as a guide will facilitate development of this manual.

**Safety Management Processes**

Six safety management processes are the backbone of the safety management cycle. ANSI/ASSE Z15.1-2012 matches well with these processes.

1) **Policies and procedures** define the what and how of a motor carrier’s operations. Policies establish the guidelines for how a motor carrier and its employees behave in a given situation. Procedures explain how to accomplish policies. The other safety management processes focus on how to implement these policies and procedures. 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 do not 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. An effective 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 recruit-
ing 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 development of driver qualifications, job descriptions, applications and background checks. A carrier should have a defined policy that lists minimum qualifications or disqualifying events (which should be concrete provisions that do not fluctuate with the job market) and have systems in place to conduct adequate background checks as required by statute. A carrier should also consider other processes that are not required, such as preemployment 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 functions. ANSI/ASSE Z15.1-2012, Section 3.2.1.5, covers orientation and training, and Section 5.3 covers driver training. Ideas from these sections should 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 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 employees execute their roles and responsibilities. Monitoring involves a motor carrier evaluating the operation’s performance, while tracking entails 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 executed.

6) **Meaningful action** gives motor carriers the tools to correct or improve employee behavior, including training and positive reinforcement such as rewards or bonuses, to improve a carrier’s overall safety performance. Sections 7.2.3, 7.2.4 and 7.2.5 address corrective action and incident review, which are meant to spur meaningful action.

Merging ANSI/ASSE Z15.1 with federal guidance results in a thorough policies and procedures manual. The “Recommended Outline” on p. 52 lists additional elements to include in the manual.

**A Systems Approach to Roadway Safety**

The thinking about how to best achieve road safety improvements has gradually shifted over the past 2 decades. This shift is marked by a 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 infrastructure and vehicles (Organization for Economic Cooperation and Development, 2008).

**Vision Zero & 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 continuously modifying the road system as situations in which human error leads to crash-related injuries are identified (Johansson, 2009). Traditional road safety approaches aimed at preventing crashes, while the Vision Zero goal is to eliminate death and serious injury. This model accepts that road users will inevitably make errors, so 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 calls for a management system at the organizational level that is responsible for modifying work conditions to reduce, if not eliminate, the potential for road traffic injury. A primary contribution of this model is its support for shifting responsibility away from the individual driver toward the company or organization that employs the driver.

Similar road safety initiatives have been adopted in other countries, most prominently in the Netherlands (Sustainable Safety strategy) and Australia (Safe System model) (Organization for Economic Cooperation and Development, 2008). In 2009, the U.S. began to move in a similar direction with the launch of Toward Zero Deaths (http://safety.fhwa.dot.gov/tzd), a strategy that conceptualized any injury or death on the road as unacceptable.

**The ISO 39001 Standard**

Another outgrowth of the safe system approach to road safety is ISO 39001:2012, Road Traffic Safety Management Systems—Requirements With Guidance for Use. Because the Swedish Standards Institute is secretariat for ISO 39001, this global consensus standard was strongly influenced by Vision Zero. This standard was designed for use by any public or private organization seeking 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 ANSI/ASSE Z15.1, ISO 39001’s requirements are placed within a framework of roads, vehicles and users.

**ANSI/ASSE Z15.1 as a Systems Approach**

ANSI/ASSE Z15.1 is consistent with the safe system approach in several ways:

- It assumes that the organization is responsible for developing programs, policies and procedures to manage road risk associated with any motor vehicle operated on its behalf.
- It addresses management of risks related to the driver, vehicle and operating environment.
- It advocates continuous measurement and review to document successes and to identify areas for improvement.
The global initiatives and ANSI/ASSE Z15.1 share common features that are especially relevant to the management of vehicles by companies and organizations:

- They value comprehensive management and communications structures that incorporate all stakeholders, including private- and public-sector groups that are key users of the road system.
- They see road safety as a responsibility shared among all these stakeholders.

**Recommended Outline for Policy & Procedure Manuals**

I) Safety Policy/Statement
   A) Safety mission statement that is conveyed on a constant basis

II) Responsibility & Accountabilities
   A) Policy setting forth who is responsible for what. Very important.
      1) Assignment of safety functions
      2) Assignment of auditing requirements
      3) Chain of command on safety issues

III) Driver Recruitment
   A) Assessment
      1) Job description, with safety expectations
      2) Road test
      3) Written test (not required)
      4) Background check
         a) Work history documentation
         b) Drug and alcohol checks
         c) Criminal history, if required
   B) Selection guidelines
      1) Experience required
      2) Medical examination
      3) Motor vehicle record (MVR): what is acceptable
      4) Preemployment safety screening program report/roadside history
      5) If owner/operator, a review of DOT number

IV) Orientation & Training
   A) New employee training and orientation
      1) New driver checklist
      2) Driver qualification files
         a) Biennial review of file
         b) Annual MVR checks
         c) Review of driver qualifications
            i) Hazmat
            ii) Entry level
            iii) Longer combination vehicles
            iv) Tanker driver trainer
            v) New driver ride-alongs
      6) Training on your equipment and configurations
      7) Drugs and alcohol
         i) Decision on allowing return to work
         ii) Retention and storage of records
         iii) Procedure for immediate removal
   B) Employee retraining
      1) Postcrash
      2) Postincident
   C) Recurrent training
      1) HazMat
      2) OSHA safety training
   D) Specialized training
      1) Tanker
      2) Load securement
      3) Longer combination vehicles

V) Organizational Procedures & Rules
   A) General discipline procedure that can be applied to safety and operational violations
   B) General safety policies
      1) Required by regulations
         a) Drug and alcohol testing procedures/policies (if you employ drivers with a commercial driver’s license)
         b) Security plan (if you haul hazardous materials)
      2) Company directed
         a) Passengers
         b) Personal use
      3) Compliance with all traffic and motor carrier regulations and laws (general in nature)
   C) Crash countermeasures/driving practices
      1) Distracted driving
      2) Weather/dispatch policy
         a) General
         b) Procedures to hold dispatchers accountable for dispatching drivers on runs that cannot be made legally
      3) Speed policy
      4) Following distance policy
      5) Right lane/lane change policy
      6) Safety belts
      7) Hours of service

VI) Incident & Crash Review
   A) Evidence retention
   B) Black box retention policies
   C) Files and photos
   D) Purpose of incident and crash reviews:
      1) Preventability determination?
      2) Development of procedures/training to prevent future crashes?

VII) Rewards & Recognition
   A) Does the company have a system to reward and recognize driver achievements?

VIII) Vehicle Specification & Selection
   A) 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.

IX) Inspection & Maintenance
   A) Does the company have a policy describing the system to:
      1) Maintain records
      2) Maintain system of preventive inspections
      3) Roadside inspections reported
      4) Driver vehicle inspection report
   B) If company uses owner/operators (O/O), policy to review O/O equipment prior to allowing use? Policy on repairs of O/O equipment?

X) Management Program Audits
   A) Is there a procedure specifying audit functions that management does to ensure that requirements are being met at all levels? Are they reported back to top management?
• They value continuous data collection and feedback, including cost and economic analysis to ensure that investments in road safety are effective and provide a favorable return on investment (Organization for Economic Cooperation and Development, 2008).

**Develop & Implement a Motor Vehicle Safety Program With Z15.1**

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, 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. Organizations can use the standard’s basic structure at several points during program development and implementation: 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 & Implementing Interventions**

The Haddon matrix is a tool that can be used in conjunction with ANSI/ASSE Z15.1 to identify program gaps. It was developed by American epidemiologist William Haddon Jr., a prominent advocate for crash prevention and injury control and the first administrator of National Highway Traffic Safety Administration. Haddon conceptualized injury prevention as a problem of reducing or eliminating the exchange of harmful mechanical energy (Haddon, 1968). The simplest version of the matrix is a 3 x 3 table (Figure 3, p. 54). The rows denote phases, or points in time when a hazard is present or an intervention can be put in place. The columns denote factors, or sources of risk or points of intervention to control the risk (Haddon, 1972).

Use of this 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 ANSI/ASSE Z15.1. Haddon (1968) showed how the human data cell could be separated into road user types such as drivers, pedestrians, and motorcyclists, allowing a more refined assessment of risks and interventions.

For organizational users, research and policy documents have recommended the addition of columns to cover factors related to management and journeys (e.g., European Transport Safety Council). Addition of information on management reinforces ANSI/ASSE Z15.1, which covers the importance of leadership, management commitment, and a strong administrative structure before discussing 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. Doing so promotes broad buy-in across organizational units and guards against the danger of entrusting the program to a single individual whose departure could threaten the program’s future (Murray, Ison & Gallemore, 2009).

The Haddon matrix helps a company identify program gaps by asking these questions: “Which of these risks are we addressing?” and “Where are policies and procedures needed?” For identifying and implementing interventions, the matrix helps a firm to ask, What interventions can we put in place to reduce or eliminate these risks? Table 1 (p. 54) shows how the matrix might be used to assess program gaps or to check for compliance with ANSI/ASSE Z15.1 elements.

Several 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, Scurfield, Sleet, et al., 2004). In addition, the plan of action developed for the UN Decade of Action for Road Safety 2010-2020 is based on five pillars: 1) road safety management; 2) safer vehicles; 3) safer roads and mobility; 4) safer road users; and 5) postcrash response (World Health Organization and UN Road Safety Collaboration, 2010). These pillars mirror both the Haddon matrix and sections 3 through 6 of ANSI/ASSE Z15.1. Finally, fleet and safety managers, fleet service providers and researchers have reported successfully using the matrix to assess program gaps (Darby, Murray & Raeside, 2009; Murray, et al., 2009; Wallington, Murray, Darby, et al., 2012).

**Develop Metrics & Track Progress With Z15.1**

The main portion of ANSI/ASSE Z15.1 requires an organization to follow a process of reporting, reviewing, analyzing and taking corrective action in response to individual motor vehicle incidents and collisions. It also prompts an organization to take a broader view by collecting data needed to track road safety performance over time.

Early in its deliberations, the Z15 ASC determined that the standard should not mandate that all organizations use the same outcome measures or the same reporting intervals. Thus, the standard contains appendices with more specific but non-mandatory guidance in these areas to allow an organization to determine what is most appropriate. In the 2012 version:

- 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 consider during incident/collision reviews. 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.

**Rate Calculation Examples**

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 is the exposure unit

Organizations can use the standard’s basic structure to identify gaps in an existing program, to ensure that policies and procedures are adequate and to develop key performance indicators.
The Haddon matrix can be used in conjunction with ANSI/ASSE Z15.1 to identify program gaps. The rows denote points in time when a hazard is present or an intervention can be put in place. The columns denote sources of risk or points of intervention to control the risk.

An incident rate based on the number of vehicles is essentially the percentage of the vehicle fleet involved in an incident over some predetermined period. It can help an organization assess the percentage 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:

\[
\frac{\text{Number of incidents} \times 100}{\text{Number of vehicles}}
\]

Rates based on vehicle miles traveled 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 different types or models of vehicles in the fleet, or under different operating conditions.

### Table 1

**Haddon Matrix Adaptation Example**

<table>
<thead>
<tr>
<th>Original elements of Haddon Matrix</th>
<th>Additional elements for occupational road safety</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human</strong></td>
<td><strong>Vehicle</strong></td>
</tr>
<tr>
<td><strong>Pre-crash</strong></td>
<td></td>
</tr>
<tr>
<td>Formal criteria for:</td>
<td></td>
</tr>
<tr>
<td>• Driver qualification and selection (3.2.1.3, 5.1.1, 5.1.2)</td>
<td></td>
</tr>
<tr>
<td>• Motor vehicle record checks (5.1.3)</td>
<td></td>
</tr>
<tr>
<td>• Driver orientation and training (3.2.1.5, 5.3)</td>
<td></td>
</tr>
<tr>
<td>Driver management program (5.2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Policy for business and personal use of</td>
</tr>
<tr>
<td></td>
<td>organizational vehicles (4.7.1, 4.7.2, Appendix A, B)</td>
</tr>
<tr>
<td></td>
<td>Policy for business use of personal vehicles (4.7.3, Appendix C)</td>
</tr>
<tr>
<td><strong>Crash</strong></td>
<td></td>
</tr>
<tr>
<td>Instructions for drivers in the event of a crash (7.1.1, Appendix F, A)</td>
<td></td>
</tr>
<tr>
<td>Emergency equipment/kit for use in the event of a crash (6.3)</td>
<td></td>
</tr>
<tr>
<td><strong>Post-crash</strong></td>
<td></td>
</tr>
<tr>
<td>Corrective action directed at driver, if appropriate, to improve skills and behaviors (7.2.4, 7.2.5)</td>
<td>Corrective action related to vehicle policies, if appropriate (7.2.5)</td>
</tr>
<tr>
<td>Policies for managing crash scene (Appendix F)</td>
<td>Policies for interactions with law enforcement and third parties at the scene (Appendix A)</td>
</tr>
</tbody>
</table>
The calculation of the rate of injury incidence is another good example of the flexibility afforded by ANSI/ASSE Z15.1. The numerator may be adjusted in several ways. At the outset, it is important to establish an organization-wide definition of an injury. Z15.1 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.” By design, this definition does not dictate specific criteria; instead, an organization may choose its own threshold. Common 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, the numerator 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:

\[
\text{Number of incidents with injury x 1,000,000}
\]
\[
\text{Vehicle miles traveled}
\]

Data collection should be linked to specific reporting requirements: those needed to calculate basic rates described above and those that contribute to calculation of KPIs. (There are many other reporting requirements related to financial, human resources and regulatory compliance, but these are outside the scope of this article.) 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 (e.g., a set level in reduction in crashes per million miles). The rates highlighted in the appendix are outcome measures.

Processes are also important because they represent milestones along the way to achieving outcomes, and they can pinpoint places in the management system where adjustments are needed to continue progress toward the desired outcome (Poister, 2004). A process indicator relevant to ANSI/ASSE Z15.1 might be the percentage of workers completing behind-the-wheel training within 6 months of hire.

The Haddon matrix example (Figure 3) can be a starting point for developing process and outcome KPIs for specific program areas. Figure 4 shows how an organization might determine what is needed to support a KPI related to distracted driving crashes. Some process-related measures are quantitative, while others will be based on more qualitative assessments and knowledge of the organization. It is important to note the distinction between a KPI and a target value for that indicator. A KPI is the measure, but the organization should also determine the value it wants to achieve for that KPI.

### Developing & Using Key Performance Indicators

Basic rates listed in Appendix H of the standard are useful for summarizing an organization’s road safety performance and tracking progress over time. The standard can also help an organization set targets and track progress toward specific program goals and objectives. Again, elements of the standard, organized within the Haddon matrix, help an organization select the most appropriate KPIs and ensure that data are being collected to calculate these indicators.

When considering data collection related to management of a motor vehicle safety program, an employer must not lose sight of which data elements are essential and which are merely good to know. Data collection should be linked to specific reporting requirements: those needed to calculate basic rates described above and those that contribute to calculation of KPIs. (There are many other reporting requirements related to financial, human resources and regulatory compliance, but these are outside the scope of this article.) Data elements are generally a combination of process and outcome measures.

### Example KPI Supporting Data

#### Sample KPI: % of “preventable” incidents in which the organization’s driver was distracted

<table>
<thead>
<tr>
<th><strong>Relevant data elements:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Total number of incidents (based on the organization’s predetermined criteria for defining an incident).</td>
</tr>
<tr>
<td>• 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).</td>
</tr>
<tr>
<td>• Number of “preventable” incidents (based on incident review procedures).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>“Process” measures to support this KPI:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Does the organization have a cell phone policy or a more general distracted driving policy?</td>
</tr>
<tr>
<td>• What percentage of the organization’s drivers has signed an acknowledgment of this policy?</td>
</tr>
<tr>
<td>• How well do supervisors reinforce the importance of the policy?</td>
</tr>
<tr>
<td>• 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?</td>
</tr>
<tr>
<td>• Are there results from employee surveys on safety climate or safety attitudes that suggest how communication strategies can be adjusted to increase compliance?</td>
</tr>
</tbody>
</table>
Conclusion

ANSI/ASSE Z15.1-2012, Safe Practices for Motor Vehicle Operations, provides minimum requirements for workplace motor vehicle safety programs. Although the standard was initially conceived to fill 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 as well as FMCSA's CSA initiative by providing a critical framework for developing a safety management system and policies and procedures, a framework not found in the FMCSRs.

Because it specifies policies and procedures related to the driver, vehicle and operating environment, all within 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. PS

References


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Roof Instability

What Reportable Noninjury Roof Falls in Underground Coal Mines Can Tell Us

By T.S. Bajpayee, Deno M. Pappas and John L. Ellenberger

Ground falls have historically been responsible for nearly 50% of all fatalities in underground bituminous coal mines (Mark, Pappas & Barczak, 2009). Roof bolting in coal mines began on a modest scale in the early 1950s. Since then, the design of bolts, grout systems, accessories and installation techniques has improved significantly. Currently, roof bolting is the primary means of supporting mine roof in room-and-pillar operations in the bituminous coal sector. Although roof support systems have improved greatly, roof falls continue to occur in bolted areas. Design and maintenance of adequate support systems is essential for ensuring ground stability and preventing roof falls. (Note: The term roof falls is used synonymously with falls of roof and falls in this article.)

Coal mine operators must report two types of roof falls to MSHA: 1) falls causing injury to workers; and 2) non-injury falls in active areas that impair ventilation, impede passage of miners or extend at least to the anchorage zone of roof bolts. Most injury-causing roof falls involve falls of small chunks of roof rock from the immediate roof beam (Robertson & Hinshaw, 2002). MSHA (2010) data indicate that noninjury roof fall incidents reported to MSHA by more than 800 mines from 1999 through 2008.

Study Methods
MSHA collects incident, injury, employment and production data for the mining industry. NIOSH (2010) converts these data to SPSS and dBase IV file formats, and maintains these files on its website. For this study, the researchers retrieved relevant roof fall information from the NIOSH website.

The primary source of information for this study was operator sector data on

IN BRIEF
• Roof falls are a major hazard in underground mining. Roof bolting is the primary means of supporting the mine roof in underground coal mines. Despite great strides in the design of support systems, roof falls continue to occur in bolted areas.
• Noninjury roof fall reports provide insight into the characteristics of roof falls.
• This study examined 11,600 noninjury roof fall reports to identify geological contributors to roof falls. The goal is to provide data that can help improve roof-fall-related safety by providing direction for the research and development of improved support systems and mine layout alternatives.
roof falls in room-and-pillar operations at underground bituminous coal mines from 1999 through 2008. The study findings are limited to the information reported to MSHA as well as data available on the NIOSH website. Furthermore, various NIOSH publications provided supplemental information to augment this research. In addition, Part 50 Data User’s Handbook (MSHA, 2007) helped the authors understand the codes and retrieve necessary information. The narratives associated with roof fall incidents were examined to understand the contributing factors involved in the reported case. Although mine operators are not required to list contributory factors, these data are often reported in the narratives, which offer brief summaries that typically identify the location and size of the falls and may provide other information.

Results & Discussion

The results presented in this article relate to reportable noninjury roof falls that extended at least to the anchorage zone of roof bolts, impaired ventilation or impeded passage of miners.

Distribution of Roof Falls at Various Coal Mining Regions in the U.S.

MSHA (2007) has 10 regional offices whose staff inspect operations at bituminous coal mines: 1) western Pennsylvania; 2) northern West Virginia-Ohio-Maryland; 3) central West Virginia; 4) Virginia; 5) eastern Kentucky; 6) central Kentucky-Tennessee; 7) Illinois–Indiana; 8) western Kentucky; 9) western U.S.; and 10) Alabama. The Illinois Coal Basin comprises Illinois-Indiana and western Kentucky mining regions. Roof fall data were analyzed to study the distribution of roof falls in these 10 regions.

The average number of roof falls per 200,000 employee-hours for each region was calculated based on the number of roof falls and the employee-hours of the region. Furthermore, the average number of roof falls per 200,000 employee-hours for the U.S. was calculated to determine the national average. Roughly 200,000 employee-hours correspond to the number of hours worked by 100 full-time miners in a year.

Figure 2 plots the number of roof falls per 200,000 employee-hours for the various regions. The northern West Virginia-Ohio-Maryland region experienced the highest roof fall rate followed by the Illinois-Indiana and western Kentucky regions. Pappas and Mark (2012) also reported a higher noninjury roof fall rate for the northern West Virginia-Ohio-Maryland region. The Illinois-Indiana and western Kentucky regions can be considered as a single group because both are located in the Illinois Coal Basin. The roof fall rate in the Illinois Coal Basin is higher than the national average rate of 4.48—7.96 in the Illinois-Indiana region and 5.67 in the western Kentucky region.

Table 1 lists the number of roof falls (N = 4,393) for the top 26 individual mines arranged in descending order. The fall count was not normalized by production rate or hours worked; instead, the table simply lists the falls per mine operation during the study period (1999 through 2008).
2008). These 26 mines, which represent about 3.2% of the reporting mines, were responsible for 37.7% of all reported roof falls. Figure 3 (p. 60) shows the region-wise distribution of these 26 mines, 18 of which are located in the Illinois Coal Basin.

**Height of Roof Fall Cavity**

**Above Roofline & Bolt Anchorage Zone**

Roof falls with a cavity height of 2 ft or less are generally considered skin failures (Tadolini & Dolinar, 2001). Pertinent cavity height information was obtained from the incident narratives. Cavity height above the roofline was available for 5,514 falls (Figure 4, p. 61). The cavity height of 33.9% of falls ranged from greater than 4 to 6 ft and 29.8% ranged from greater than 6 to 8 ft. The cavity height of 11.1% of falls exceeded 10 ft. In coal mines, roof bolts are commonly 4 to 6 ft in length.

The height of roof fall cavity above the anchorage zone of roof bolts was available for 2,205 cases. Figure 5 (p. 61) shows the distribution of cavity height above the bolt anchorage zone for the cases where the cavity height exceeded bolt length. The height of roof fall cavity of 69% of falls was within 2 ft of the cavity height exceeded bolt length. This result confirms that rock exceeds the bolt length. However, collapse can occur when preexisting conditions or time-related weakening of the rock exceed the bolt length.

**Coalbeds Susceptible to Roof Falls**

The researchers attempted to examine the distribution of roof falls in different coalbeds to understand whether certain coalbeds were more susceptible to roof falls. A coalbed including its roof layers has a unique set of geological characteristics that can influence roof stability. A coalbed (also known as a coal seam) is a geological deposit of coal occurring below ground.

The coalbed codes (unique identifier of a coalbed) and associated local names were obtained from the Energy Information Agency (EIA) database of the U.S. Department of Energy. Local names listed in NIOSH’s database were matched and merged with the local names and codes listed in the EIA database. (In a geographical area, a coalbed is often recognized by its local name. Local names of a coalbed may change from one geographical area to another.) Researchers identified 96 coalbed codes accounting for 10,164 (87.25%) roof falls. It is interesting to note that eight coalbed codes (of the 96 identified codes) accounted for 5,744 (56.5%) roof falls.

Table 2 (p. 62) lists the regional distribution of roof falls ($N = 5,744$) associated with these eight coalbed codes. Code 76 represents the highest roof fall rate per 200,000 employee-hours, followed by codes 489 and 484. Code 76 is known locally in western Pennsylvania as the Kittanning coal seam; it is mined in other states as well, including Ohio, Maryland and West Virginia. The roof is generally weak due to the presence of slip planes, slickensides, clays and siltstones (Iannacchione & Puglio, 1979). In such situations, the solution is generally to increase the intensity of supports. Longer roof bolts, roof screen, straps and cable bolts are also employed to provide supplemental support and maintain safe conditions.

Coalbed codes 489 and 484 are located in the Illinois Coal Basin. They accounted for 2,812 roof falls—1,815 in the Illinois-Indiana region and 997 in the western Kentucky region. Molinda, Mark, Pappas, et al. (2008), reported that weak, moisture-sensitive roof and horizontal stress contribute to the high roof fall rate in this basin, which presents some of the most challenging roof control issues in the U.S. Solutions include applying spray-on sealants to limit rock exposure to moist air, drainage of water and applying roof screening to control damaged rock. Other more traditional approaches include installing longer roof bolts and adding straps to the support system.

**Identifying Contributory Geologic Factors From Narratives**

Many of the incident narratives examined lacked the information needed to draw meaningful conclusions relative to the contributing geologic factors. However, the researchers found well-documented narratives for 1,825 incidents and used these to group contributory geologic factors into seven categories.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Mine</th>
<th>Location</th>
<th>Roof falls</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mine 1</td>
<td>Northern West Virginia-Ohio-Maryland region</td>
<td>539</td>
</tr>
<tr>
<td>2</td>
<td>Mine 2</td>
<td>Illinois-Indiana region</td>
<td>336</td>
</tr>
<tr>
<td>3</td>
<td>Mine 3</td>
<td>Western Kentucky region</td>
<td>327</td>
</tr>
<tr>
<td>4</td>
<td>Mine 4</td>
<td>Illinois-Indiana region</td>
<td>300</td>
</tr>
<tr>
<td>5</td>
<td>Mine 5</td>
<td>Illinois-Indiana region</td>
<td>260</td>
</tr>
<tr>
<td>6</td>
<td>Mine 6</td>
<td>Northern West Virginia-Ohio-Maryland region</td>
<td>254</td>
</tr>
<tr>
<td>7</td>
<td>Mine 7</td>
<td>Illinois-Indiana region</td>
<td>201</td>
</tr>
<tr>
<td>8</td>
<td>Mine 8</td>
<td>Illinois-Indiana region</td>
<td>191</td>
</tr>
<tr>
<td>9</td>
<td>Mine 9</td>
<td>Illinois-Indiana region</td>
<td>160</td>
</tr>
<tr>
<td>10</td>
<td>Mine 10</td>
<td>Western Kentucky region</td>
<td>150</td>
</tr>
<tr>
<td>11</td>
<td>Mine 11</td>
<td>Illinois-Indiana region</td>
<td>148</td>
</tr>
<tr>
<td>12</td>
<td>Mine 12</td>
<td>Western Kentucky region</td>
<td>140</td>
</tr>
<tr>
<td>13</td>
<td>Mine 13</td>
<td>Illinois-Indiana region</td>
<td>137</td>
</tr>
<tr>
<td>14</td>
<td>Mine 14</td>
<td>Western Kentucky region</td>
<td>131</td>
</tr>
<tr>
<td>15</td>
<td>Mine 15</td>
<td>Illinois-Indiana region</td>
<td>119</td>
</tr>
<tr>
<td>16</td>
<td>Mine 16</td>
<td>Central Kentucky-Tennessee region</td>
<td>105</td>
</tr>
<tr>
<td>17</td>
<td>Mine 17</td>
<td>Central West Virginia region</td>
<td>105</td>
</tr>
<tr>
<td>18</td>
<td>Mine 18</td>
<td>Northern West Virginia-Ohio-Maryland region</td>
<td>97</td>
</tr>
<tr>
<td>19</td>
<td>Mine 19</td>
<td>Northern West Virginia-Ohio-Maryland region</td>
<td>96</td>
</tr>
<tr>
<td>20</td>
<td>Mine 20</td>
<td>Western Kentucky region</td>
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<td>Eastern Kentucky region</td>
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<td>22</td>
<td>Mine 22</td>
<td>Illinois-Indiana basin</td>
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<tr>
<td>23</td>
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<td>Western Kentucky region</td>
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</tr>
<tr>
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<td>Mine 24</td>
<td>Virginia region</td>
<td>84</td>
</tr>
<tr>
<td>25</td>
<td>Mine 25</td>
<td>Illinois-Indiana region</td>
<td>78</td>
</tr>
<tr>
<td>26</td>
<td>Mine 26</td>
<td>Illinois-Indiana region</td>
<td>70</td>
</tr>
</tbody>
</table>

Total 4,393

*Note. Data from accident, illness and injury and employment self-extracting files (Part 50 data). Retrieved from www.msha.gov/ACCINJ/accinj.htm*
Slip in the Roof

The slip in the roof category primarily includes slip in the roof rock above the roof level. Presence of slick rock and slickenside-rock in the roof layers are also included. When two slips intersect at an obtuse angle above the roof level, a roof fall may occur. Often, these slips were identified only after the roof fall had occurred. In such circumstances, mine operators generally reported that the roof fall had occurred due to the presence of an undetected or unexpected slip in the roof.

Prominent geological discontinuities usually create a sliding surface and thereby weaken the rockmass’s overall strength. Differential movement of rock layers on a slip surface occurs due to stress re-adjustment caused by mining. A slickenside, slip or shear is actually a failure surface on which there has been lateral movement of shale or other clay-rich rocks (Molinda, 2003). In the narratives, slip was found to be the primary contributing factor most frequently associated with roof failure (Figure 6, p. 62).

Laminated Roof

Presence of thin laminations in a weak roof beam can contribute to entry failure. Laminations in the roof beam cause it to be subdivided into multiple thin beams. Weak, thin beams tend to separate and deflect downward into the mine entry. In addition, mining-induced stress could initiate progressive shear failure in thin layers of roof beam (Iannacchione, Esterhuizen, Bajpayee, et al., 2005). The interface material between adjacent layers may fail as well, causing differential movement in the layers and thereby weakening the overall rockmass strength. In the narratives, the presence of laminations in the immediate roof beam was reported as the second largest contributory factor for roof falls (Figure 6). Photo 1 shows failure of laminated roof in a coal mine (Esterhuizen & Bajpayee, 2012).

Figure 3
Region-Wise Distribution of Mines Listed in Table 1

Draw Rock

Draw rock (also known as draw slate, draw shale and stack rock) is a shale or mudstone unit that lies immediately above the coal bed and is too weak to be self-supporting, thus tending to fall when coal is mined. It deteriorates due to exposure to moisture or water percolating through the roof. Stack rock is a sequence of rock composed of interbedded sandstone and shale; it is often associated with weak or poor-quality roof. Stack rock may be strong axially depending on the proportion of sandstone in the mix, but is typically weak along the bedding planes and could fall under high horizontal stress (Molinda, 2003). Draw rock is the third largest contributory factor associated with roof falls (Figure 6).

Wet Roof

The wet roof category includes water in roof, percolation in roof and moist roof. Water tends to weaken the bonding between roof layers, particularly in roofs containing shale, clay and mud rock. Additionally, several roof rocks in the Illinois Coal Basin are moisture sensitive and often degrade when exposed to water (Molinda, 2003). Water percolating from roof induces swelling and loss of strength in many poorly jointed shale rocks. The process is progressive and eventually results in roof failure. Wet roof is the fourth largest contributory factor associated with roof falls (Figure 6).

Rider Seam

Rider seam and rider coal have been reported synonymously in the database. Rider seams are minor coalbeds deposited over a thicker coalbed (Molinda, 2003). The thickness of rider coal often ranges from several inches to a few feet. Shales with a high carbonaceous content or coal streaks above the roof horizon have often been reported as rider coal. Rider coalbeds are weak. Rider coal just a few inches thick over the anchorage zone of roof bolts could initiate roof failure. Rider coal is the fifth largest contributory factor for roof falls (Figure 6).

Clay

During the coal formation period, silt and clay were deposited parallel to the bedding plane or even injected across the bedding at an angle. Clay veins usually reduce the overall strength of the roof rock and may initiate roof failure. Molinda (2003) reported occurrences of roof problems due to clay veins in Pennsylvania and central Illinois. The incident narratives reviewed listed presence of clay in the roof rock as a contributory factor for numerous roof falls.

Cutter

The cutter category also includes roof falls due to the presence of high horizontal stress. Horizontal stress associated with poor rock quality is known to have initiated cutter failure in the Illinois Coal Basin (Molinda, 2003). (In this context, the word cutter is synonymous with the term gutter or roof gutter.) Fur-
thermore, when the horizontal stress exceeds the vertical stress, it may cause cutter failure. Photo 2 shows initiation of roof cutter in a coal mine (Esterhuizen & Bajpayee, 2012). No unique solution exists for controlling or avoiding cutter roof failure (Hill, 1986). Even at shallow depths, horizontal stress is a concern for entry stability. Mark and Mucho (1994) and Su and Hasenfus (1995) reported that horizontal stress is often higher than the vertical stress in coal-bearing rock formation.

Interestingly, three factors—slip, laminated roof and draw rock—were reported to be associated with about 75% of 1,825 roof fall incidents that included geologic factors in the narratives. In operating mines, the solution to these unfavorable geological factors includes the installation of supplementary support or modification of the mining layout.

A well-known approach to improve roof stability is to simply reduce the width of the excavations. Other techniques may be to reorient the direction of mining so that it is more favorable relative to the major horizontal stress (Mark & Mucho, 1994). Supplementary supports in the form of additional roof bolts, straps or screen (chain-link or welded steel mesh) may be installed to increase the areal coverage of the supports. Installing longer roof bolts or cable bolts is very effective, especially if the longer supports are able to anchor in stronger layer.

Conclusion

Falls of roof continue to be a major hazard in underground coal mining. This study examined 11,600 reportable noninjury roof falls that occurred from 1999 to 2008 in room-and-pillar operations in the bituminous coal sector. An average of 1,160 falls were reported per year during the study period. Key findings include the following:

• Coal beds mined in the Illinois Basin region are susceptible to roof falls. In this region, roof instability is associated with moisture sensitivity of the weak shale roof rocks and horizontal stress related damage.

• The geological structures most commonly mentioned in the roof fall narratives were slips, laminated roof and draw rock. Timely identification of the presence of these structures can help to ensure that appropriate supports are installed to control their negative effects on roof stability.

• About 70% of roof fall cavities extend no more than 2 ft above the bolted horizon. This finding confirms the effectiveness of bolting in providing support to the rock within the bolted horizon. It also seems to indicate that roof deterioration occurs over time and collapse can occur when the weakened roof has progressed beyond the length of the bolts.

The study has highlighted the coal-producing regions and geological issues related to high roof fall rates in underground coal mines. These results can be used to direct research, support technology development and mine layout alternatives.

References


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Table 2
Regional Distribution of Roof Falls, Top Eight Coalbed Codes

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<tr>
<th>Coalbed Code</th>
<th>Western Pennsylvania region</th>
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<th>Central West Virginia region</th>
<th>Virginia region</th>
<th>Eastern Kentucky-Tennessee region</th>
<th>Illinois-Indiana region</th>
<th>Western Kentucky region</th>
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<th>Roof falls per 200,000 employee-hours</th>
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Figure 6
Contributory Factors Leading to Roof Fall

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Disclaimer
The findings and conclusions in this article are those of the authors and do not necessarily represent the views of NIOSH.
Getting Started With Prevention Through Design

By Marjory E. Anderson & Craig Galecka

If you ask someone in the safety profession, “Do you want to reduce risk and save money at the same time?” the answer is always a resounding “yes.” That is why the concept of prevention through design (PTD) has gained so much momentum in the past few years.

PTD is an invaluable tool that allows organizations to address safety measures early in the design process, which has proven to decrease risk and save money. Risk is minimized by eliminating hazards before they are created and applying solutions that are high in the hierarchy of controls. Costs are reduced in two ways: 1) by applying the initial solution; and 2) by minimizing injuries, reducing claims and decreasing lost production time.

Applying PTD can have a dramatic impact on an organization’s overall safety program, since it applies to all aspects of safety—from fall protection to electrical safety to confined spaces. PTD principles can be used when designing process upgrades, renovations, demolitions and new construction.

Even if one conceptually agrees with PTD, how can one begin to implement it in an organization? This article explains key principles for getting started with PTD and concludes with how one organization implemented the process.

In the Beginning

While the PTD concept can be applied to any project, it is ideal to have a coordinated PTD program that is accepted throughout the organization. In 2011, ANSI published a new consensus standard related to this concept called ANSI/ASSE Z590.3-2011, PTD Guidelines for Addressing Occupational Hazards and Risks in Design and Redesign Processes. The standard provides guidance on roles, responsibilities, review processes and documentation that enhance the implementation of PTD principles.

Figure 1 (p. 64) shows a sample process for planning and implementing a PTD program. By developing the program before implementing PTD on projects, the stakeholders will understand the benefits and processes required to be most successful. Without developing a program, more time will be spent during implementation to educate team members and gain their buy-in for cooperation.

Management backing is essential to develop and maintain a PTD program. When managers hold design teams accountable for minimizing risk, everyone is more motivated to ensure that safety is considered early and often. Ideally, this becomes part of an organization’s culture and everyone embraces the idea of addressing safety throughout a project’s continuum.

Applying PTD can have a dramatic impact on an organization’s overall safety program, since it applies to all aspects of safety—from fall protection to electrical safety to confined spaces.

Applying PTD

When applying PTD, the project manager has a high level of responsibility. The project manager must understand the project, as well as the PTD process, and identify the necessary team members, including representatives from safety. For PTD to be completely successful, safety personnel should be involved from project onset.

Figure 2 (p. 65) shows a typical design process. In many organizations, safety is not engaged until the very end of the design process or after the construction or installation is complete. Waiting to address safety issues affects more than just overall safety and cost. Ongoing operations and maintenance can be impacted as well. Consider adding roof penetrations for a rooftop fall protection solution; not only are these penetrations more costly, but also they create significant maintenance issues.

With PTD, representatives from safety are engaged throughout the process (as indicated by a red S in Figure 2). The project can more thoroughly address safety for construction, operations and ongoing maintenance activities if safety professionals are engaged during the entire process.

What Are You Looking For?

The goal of involving safety personnel early in the process is to catch and correct safety issues before they become problems for operations personnel, maintenance workers, employees or visitors. It is critical to understand exactly what to look for during reviews. The following list highlights main items to consider:

- basic project information (e.g., project goals, location, operations, disciplines needed);
- confined spaces;
- electrical safety (e.g., control panels, junction boxes);
- environmental issues (e.g., HazMat, air quality);
- ergonomic issues;
- fall protection (e.g., ladders, openings, unprotected edges);
- fire protection (e.g., sprinkler placement);
- lockout/tagout concerns (e.g., placement of machinery);
- maintenance and operational tasks;
- regulatory compliance for all safety aspects.

Safety reviews must also include coordination with other disciplines. It is likely that talking to representatives from other disciplines will generate ideas and facilitate compromise and consensus. It is also helpful to talk

Design the Hazards Away

In “Design the Hazards Away: Prevention Is the Cure,” Michael C. Wright, Jeremy T. Deason and Mark E. Williams discuss eliminating hazards during the design phase. As they write, “For the hazards to be eliminated, the entire building construction and maintenance process must be considered. Design professionals have a duty to design-in safety for each worker into every phase of every building project, from construction to maintenance.”

Read the complete article at www.asse.org/psextra.
to maintenance workers, who may encounter the safety issues or use the potential solutions. Sometimes this is accomplished through one-on-one conversations. Other times, dialogue in a group setting results in the best solutions.

Case Study
For PTD principles to work, whether or not a formal PTD program is in place, safety personnel must be engaged early in the design process. Because of their background and focus on safety issues, safety personnel will recognize potential hazards while they are still lines on paper—before funds are spent on construction. These potential hazards are even more easily identified by safety professionals who have been involved in previous projects where safety issues have been designed and installed, and had to be dealt with postconstruction.

Before PTD
Safety engineer Sam is frustrated about his current project. He is managing fall hazard mitigation for his company’s newest building: a 3-year-old office building that received LEED certification. It is an impressive building that functions well for the users. However, the safety of the building’s maintainers was not considered during design. Sam has identified many fall hazards and Americans With Disabilities Act issues that would have been obvious to him during the design phase. Had he been part of the project team, he could have prevented those hazards. Instead, he is now managing a $350,000 project to correct them.

The hazard that bothers him the most is a roof walkway pad that is within 2 ft of the roof’s edge. Had he seen the plans, he would have immediately inquired about the proposed height of the parapet. Certainly, after being told that the parapet was proposed at 18 in., Sam would have insisted on modifications and saved his company hundreds of thousands of dollars.

For PTD principles to work, whether or not a formal PTD program is in place, safety personnel must be engaged early in the design process.

PTD Without a Program
While working through his current project, Sam learns that his organization plans to build a new facility next year. He is determined not to encounter the same mistakes on this new building, so he sets out to get himself or another safety professional involved in the project’s early stages. This was his plan:

1) Approach the supervisor and explain the consequences (costly repairs) of lack of inclusion of a safety specialist in the early planning and design stages of the previous project.

2) Obtain supervisor support to approach project management.

3) Approach manager in charge of project team assignments to explain circumstances and consequences of previous project; and gain approval to engage with project documents and become part of the project team.

4) Obtain back design documents.

5) Review documents and provide comments on safety concerns.

6) Participate in subsequent team meetings and design reviews.

Fortunately, Sam engaged with this project in the early stages, before significant design had occurred. Had he heard about the project in a later stage of development, he could still engage by taking the same six steps. The back design documents may be more extensive, and the safety suggestions may be more challenging to implement depending on how far the design process had progressed.

Being the proactive safety professional that he is, Sam not only engaged with the project manager for the new building, but he also talked to each of his organization’s project managers about the importance of incorporating safety in the design process. He provided examples and rationale to explain how the project budget, timeline and overall safety could be affected if safety is not included in the early stages.

Overcoming Objections
Not all of the project managers were receptive to Sam’s efforts. However, Sam was prepared to address some common objections to PTD.

Objection #1: Adding Safety Into My Project Will Affect My Bottom Line
When most people think of a well-managed project, they think of one that is delivered on time and within budget. Naturally, project managers are not interested in expanding scope and costs. While adding safety measures will add some direct costs, it will save significant money in the long run. This is especially true if waiting to address hazards will introduce ongoing operations or maintenance issues.

To overcome the concern of adding cost, articulate the long-term cost savings the organization can achieve. By spending a certain amount of money now, the organization can avoid the costs of developing a new project to address the safety issues later: additional drawings, contractor mobilization, potentially significant field modifications and reworking interferences.

Proving the significance of reducing long-term cost and overall risk often requires research. It may be worth getting a detailed cost estimate or estimating the potential impact of added risk. If the safety professional can bring these estimates to the project manager, the safety changes are more likely to occur. Essentially, the cost issue should be reversed, asking how little safety measures will cost when implemented early versus how much they will cost if implemented after project completion.

In addition, delivering a finished project that is laden with safety and health risks should not be acceptable, even if budget and schedule are
met. The potential costs of time and resources required if a violation or serious injury occurs make a convincing argument for eliminating all foreseeable risk.

Objection #2: Safety Nitpicks Every Detail & Slows Things Down

In many organizations, safety professionals have to work against the preconceived notion that safety gets in the way. In reality, safety is just another discipline that must be considered when managing a project, similar to electrical and mechanical. Incorporating safety does not necessarily mean more work. It just means thinking about the work in a different way.

Within any project team, each discipline is responsible for addressing its area of expertise and working with the team to develop appropriate solutions. By reviewing plans and drawings as part of the team, safety can provide feedback and recommendations in a timely manner. While the review may seem detailed, or even nitpicky, it is that level of detail that ensures compliance with various regulations and codes, while allowing for operational functionality.

Performing in a way that helps the project will also help overcome this objection. The safety professional must provide timely reviews and meet or exceed deadlines for providing comments. In addition to pointing out problems, offering potential solutions to the issues is beneficial and will help the project manager address safety concerns. In Sam’s example of the roof walkway pad located adjacent to an unprotected edge, the safety professional should provide potential solutions with estimated costs and an analysis of the effect on safety when reporting the issue.

Other objections may also be raised, so it is important to predict what these concerns may be. Depending on an organization’s culture, safety professionals may have to be politely persistent to effect change. Be prepared to do your homework, articulate justifications and persuade others along the way.

PTD With a Program

Thinking back to Sam’s situation, he was working to incorporate safety in an organization that did not have a formal PTD program in place. But, what if it did?

Instead of taking on the effort required to get involved in the project, safety would automatically be called upon to be a part of the project team. The initial work of establishing need, gaining credibility and developing processing for PTD would already be in place, and all parties would be aware of the procedures and expectations. When these expectations are understood by all parties, including safety personnel on the project team becomes commonplace, sometimes to the point where a team is lost without their input.

When a PTD program is in place, safety personnel are at the table for the following steps in the project timeline:

1) define program requirements;
2) initial design review;
3) second design review (and potentially more);
4) backcheck;
5) during construction.

Life-threatening safety hazards can be minimized in the most efficient way possible if safety personnel are involved in these key steps. When a PTD program is in place, no time is lost in getting the right team together, backtracking to address safety issues or allowing hazards to be introduced in new projects. Risk, time and cost are reduced when the entire team considers safety throughout the project timeline.

Conclusion

Sam’s story shows the power of PTD, and the importance of creating and using a formal PTD program. Reading his story may indicate that the outcomes were reached quickly, but remember that proper, effective, practical and safe designs are only achieved through a series of meetings and reviews that can be time consuming. But, the time invested during project design is extremely valuable when hazards can be effectively controlled, overall safety is improved and costs are reduced.

PTD offers a method for improving safety that also enables projects to be completed on time and within budget. It is a win-win method of design that benefits not only safety professionals, but also design team members, end users and organizational management.

Now, let’s get started integrating safety during design.

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Craig Galecka, P.E., CSP, is a project manager for LBJ Inc., in Okemos, MI. He specializes in safety and environmental compliance, facility decommissioning and fall prevention; manages LBJ’s safety training for clients; and has experience in fall hazard surveys, confined space audits and fall prevention system design. He is a professional member of ASSE’s Lansing Chapter.
Confined Space Winch
MSA introduces the Workman Winch for lifting, lowering and positioning personnel and materials in confined spaces. Product is designed for 400-lb personnel loads and 620-lb material loads, and has a thermoplastic exterior that withstands harsh environments. Ergonomic carrying grip allows safe transport, and bracket design provides easy assembly. www.msasafety.com

Traction Footwear
ICEtrekkers Diamond Grip footwear provides traction for maintenance personnel who work in harsh winter weather. Featuring dozens of steel grippers, product attaches to bottom of shoe or boot. The six-pointed “diamond beads” strung on steel aircraft cable provide hundreds of biting edges under the heel and ball of the foot to grip snow or ice. Design spreads load evenly from heel to toe to reduce discomfort. http://icetrekkers.com

Inspection Management
Safety-Reports.com is a web-based system to store safety inspection observations. Inspection details are automatically uploaded to a database, allowing easy access for trending and analysis. System reportedly eliminates the need for written inspection reports and promotes employee participation in the safety process. www.safety-reports.com

Hand Hygiene
Zylast antiseptic lotion by Innovative BioDefense is a water-based sanitizer. According to manufacturer, product kills 99.99% of germs on contact and is persistent for 6 hours. www.zylast.com

Mechanic’s Glove
Saf-T-Gard introduces the Mechani-Gard MG-9860 winter mechanic’s glove. Made of goatskin leather, insulated glove shields against wind and cold. Padded palms provide impact protection, while breathable knit back offers dexterity and comfort. www.saftgard.com

Lockout Software
Brady has launched the LINK360 desktop software for lockout/tagout programs. Software allows user to create, edit, save and print lockout/tagout procedures using templates for standardized procedures. User can create lockout/tagout procedures in short or long forms, and template manager allows user to control components such as notes, verification summaries and the verification column. www.bradyid.com

Facility Safety
Intella Liftparts introduces its blue safety light for forklifts to alert pedestrians to vehicles moving in reverse. Light projects a blue spot on the ground behind the forklift to warn pedestrians that it is backing into their path. www.intellaiflparts.com

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To submit a product for this section, send an e-mail to professionalsafety@asse.org. Be sure to include product and contact information, along with a high-resolution product photo.
Emergency Switch
Steute Xtreme has launched a family of emergency pull-wire switches for extreme environments. ZS71 Series resists corrosion and is designed for high-pressure and high-temperature washdowns. Product features engineered plastic housing, stainless steel hardware and reset button.
www.steutextreme.com

Water Purifier
Developed by SimpliPure, the LifeCan is a portable water purifier that produces safe drinking water from any nonsalt water. Product reportedly filters 99.9999% of bacteria and 99.99% of viruses. It is designed for emergency preparedness and for communities in which no safe supply of drinking water is available.
http://thelifecan.com

Flame-Resistant Shirt
TECGEN Select’s Dress Uniform Shirt is a flame-resistant work shirt with arc thermal protection. According to manufacturer, product is the lightest weight flame-resistant shirt available that is certified for arc-flash protection and flash fire resistance. Product is available in six colors.
www.tecgenselect.com

Earplug
Honeywell introduces the Howard Leight FirmFit foam earplug. Product offers an NRR of 30 and is reportedly 40% softer than comparable products. Device is available with or without cords.
www.howardleight.com/firmfit

Path Markings
American Permalight Inc. offers photoluminescent signs and egress path markings. Product line includes photoluminescent antislip tape and aluminum profile with photoluminescent and black antislip inserts for marking stairs, landings and handrails. Products reportedly comply with International Building Code and International Fire Code requirements.
www.americanpermalight.com

Fume Extraction
Miller Electric Manufacturing Co. introduces the FILTAIR Capture 5, a fume extraction system that captures welding fumes up to 5 ft away from the source. This extended fume capture helps maintain a clean breathing zone for the welder and helps reduce fume particles in the facility. Product is suited for heavy equipment manufacturing, general fabrication and maintenance applications.
www.millerwelds.com

Gas Detection
Industrial Scientific Co. introduces the MX6 refuge chamber kit, a portable gas detection solution that monitors gases inside and outside of mine refuge chambers during emergencies. Kit includes two MX6 iBrid multigas detectors, one of which has a pump, and various accessories including batteries, pump filters, exhaust fittings, sample tubing and instruction manual.
www.indsci.com

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www.americanpermalight.com
At 21.2 fatal work injuries per 100,000 full-time workers, the agriculture, forestry, fishing and hunting industry showed the highest fatal incident rate in 2012 according to BLS data. Field-workers and those who are responsible for numerous farming activities on family-owned farms are exposed to various hazards that can potentially turn fatal.

“Agricultural workers don’t want to do things unsafely,” says Tabitha Laser, health, safety, security and environment, risk and compliance manager at BP Alternative Energy and vice chair of ASSE’s Agricultural Branch. “They just may not understand the risks.”

Lack of awareness regarding hazards may be especially prevalent on family farms where owners often believe hazards are not present based on a long personal history of conducting agricultural operations with zero incidents.

**Hazards Pesticides**

An estimated 5.1 billion lb of pesticides are applied to crops annually, posing risks of short-term illnesses, such as digestive problems, skin irritation, headaches and breathing trouble, as well as long-term illnesses including cancer, infertility, neurological disorders and respiratory conditions. Higher rates of birth defects, developmental delays, leukemia and brain cancer in the children of field-workers are conditions also attributed to pesticide hazards.

“The pesticides can present a hazard to applicators, to harvesters reentering a sprayed field, to family members due to take-home contamination and to rural residents via air, groundwater and food,” says Michael Wolf, senior manager of environment, safety and health at Exelis and chair of ASSE’s Agricultural Branch.

**Exposure**

EPA’s Worker Protection Standard (WPS) identifies handlers and workers as the two types of employees who are most often exposed to pesticides. Handlers are those who mix, load or apply pesticides, as well as clean or repair pesticide application equipment. They can be exposed via spills, splashes, spray and drift. Workers perform tasks in areas where pesticides have been sprayed, including inside nurseries and greenhouses, and are often exposed by touching pesticide residue on plants and other surfaces or by inhaling chemical drift from nearby fields.

Handlers and workers alike face exposure risks when wearing defective or inadequate PPE or if they consume contaminated produce or eat with contaminated hands. Additionally, workers are at risk when drinking from, bathing in or washing their hands in irrigation canals or holding ponds where pesticides often accumulate.

Field-workers and those who are responsible for farming activities on family-owned farms are exposed to various hazards that can potentially turn fatal.

**Standards & Regulations**

WPS is a regulation for agricultural pesticides; it helps EPA oversee pesticide use and aims to reduce the risk of pesticide poisoning and injury. The standard protects employees on farms, forests, nurseries and greenhouses, and contains requirements for pesticide safety training, notification regarding pesticide application, use of PPE, restricted-entry intervals following pesticide application, decontamination supplies and emergency medical assistance.

“Chemicals must be properly labeled so farmworkers know the identity and hazards of the chemicals they may be exposed to at work,” Wolf says. The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) under EPA requires that all pesticides used in the U.S. must be registered with EPA. FIFRA assures proper labeling that notes all rules for pesticides, including PPE, usage guidelines and information about restricted entry intervals. The act also mandates that pesticides will not cause unreasonable harm to the environment.

**Training & Prevention**

“The most important thing you can do is make sure that all of your workers are trained,” Laser says. She adds that even workers who are licensed may not be trained to recognize every risk to which they are exposed.

Training should be customized according to whether the individual is a handler or a worker. Handlers must be aware of safety strategies when mixing and applying pesticides. Workers must understand warning signs and observe restricted entry intervals.

Employers can mitigate risks by evacuating workers to fields where chemicals have not recently been sprayed before pesticide application begins and by establishing multiple meeting locations. Less hazardous chemicals can also be used instead of toxic pesticides, but decisions regarding switching pesticides should be made carefully since less hazardous chemicals may be more flammable.

**Weather Heat Exposure**

Like many outdoor workers, individuals who tend fields are often at risk for heat-related illnesses such as heat stroke, heat exhaustion, heat cramps, heat rash and dehydration.

**Dehydration**

Laser stresses the importance of maintaining electrolytes and staying hydrated, recommending that managers keep urine charts posted for field-workers to view. Commonly used in the military, these charts illustrate how an individual’s urine darkens when s/he is becoming dehydrated. Those who have familiarized themselves with such charts can easily assess whether they are adequately hydrated, slightly dehydrated or at risk of dehydration-related illness.

While drinking water is critical to combat heat exposure, some cases of heat stroke have occurred when the worker drank too much water without maintaining the correct balance of water and sodium. Rather than just drinking large quantities of water, workers also need to replace electrolytes, including sodium. This can be accomplished by using electrolyte replacement drinks or by consistently eating foods like crackers and bananas during water breaks.

According to Jose Perez, health and safety director of Continental Labor...
& Staffing Resources, one considerable challenge is that workplaces and employees will skip breaks to continue making money, failing to take the time to drink and eat. Perez adds that breaks are necessary and staying healthy is important to production.

**Heat Illness Prevention**

All workers should be trained according to OSHA standards, which specify that field-workers rest in the shade, wear hats and light-colored clothing, learn the signs of heat illness, know how to respond to an emergency, watch out for fellow workers and drink water every 15 minutes.

Providing safe, shaded areas for workers is critical because far too often, workers die as a result of seeking shade under parked vehicles and equipment. Workers who fall asleep under machinery may not be seen by others and risk being run over if the vehicle is started.

Workers should wear layers of light, breathable clothing that allows perspiration, but wicks sweat away from the body. In addition, workers can use neck-cooling bandanas to fend off the heat. Providing each worker with two bandanas allows them to soak one in ice water while wearing the other and continuously alternate during the day.

Heat exposure issues are covered in WPS, making it an ideal educational tool. According to Perez, billboards can also be helpful for raising awareness about heat concerns, as educating families and the community is just as necessary as educating workers.

**Cold Exposure**

In some climates, cold temperatures can be hazardous for field-workers. OSHA suggests that workers learn the signs of serious illnesses caused by cold exposure. For example, hypothermia causes uncontrolled shivering, slurred speech, clumsy movements, fatigue and confused behavior. Work should be performed in pairs so that workers can observe each other and recognize warning signs.

Also, workers should try to work during the warmest part of the day; avoid fatigue since energy is needed to keep muscles warm; consume warm food and beverages; avoid caffeine and alcohol; and wear appropriate clothing, including adjustable layers.

**Storms**

Lightning during storms can affect workers located in remote fields, as they may not have access to shelter. Seeking shelter inside a vehicle does not protect from lightning strikes if the individual has any direct contact with a metal part of the vehicle. While most metal parts of car interiors are covered with cloth or plastic, the metal interiors of tractors and other farm equipment are most often exposed, putting workers at a greater risk.

Some farms have procedures requiring that if lightning strikes within a certain distance, all workers must stop work and put their hands on their laps. Other response strategies include training workers to move to the middle of the field and curl up in a ball in the event of a storm. However, some preparedness strategies for storms may need to be altered for specific locations. “During a tornado, you need to seek shelter,” Laser says. “If shelter is not available, find a low-lying ditch, but in many southern states, one of those may have an alligator in it.”

Farm owners may also use technology to protect themselves and their workers from storms. Numerous mobile apps are available that can detect lightning and provide other weather services, such as the Tornado Warning app from the American Red Cross, the Lightning Finder app and the Hurricane Hound app.

**Other Weather Concerns**

“Usually farmers want rain but they don’t want too much rain,” Laser says, noting that flooding can be hazardous to worker safety as well as damaging to crops. Workers should know the hazards that high winds and dust can present, especially if they drive equipment, as windswept dust can reduce visibility. Low visibility due to dust or fog may create a hazard for employees driving to work, and employers should ensure that the correct precautions are taken.

**Machinery & Vehicle Hazards**

**Transportation**

“One risk that continues to be present is the chance of injury when operating a vehicle,” Perez says. According to BLS, the number-one risk for agricultural workers is vehicular hazards.

Training is critical, especially regarding emergency scenarios. When driving into canals and waterways between fields, submersion can occur, and most people are not prepared to escape.

Defensive driving on and around farms is also a problem, as is underreporting. Operating a tractor or other farm equipment does not require a license, which results in children age 12 and younger driving dangerous equipment, without proper training. Teaching workers to use seat belts is another important training element that is often overlooked.

**Equipment**

“My dad operated a tractor when he was younger and he said so many times that he was lucky he didn’t die on a tractor,” Laser says. Tractor turnover is one of the most common types of incidents, and it can be avoided by training users and installing rollover protective structures, which are cabs or frames that extend above occupants’ heads and typically limit a side turnover to 90°. Such systems are not always used because they are expensive, but even on family farms operators must understand the limitations of the equipment and take necessary steps to protect themselves.

**Other Hazards**

**Confined Spaces**

“Confined spaces/ag-safety/index.php” says Perez, noting that one of those questions includes defining what constitutes a confined space.

Asphyxiation from manure pit gases is one of the most serious confined space hazards on farms, and individuals who are not trained to work directly with manure pit operations should not go near such underground structures. In 2007, five people were killed by methane gas in a manure pit in Harrisonburg, VA, when a farmer went into the pit to transfer manure out of it and was overcome by fumes. A farmhand tried to rescue him but was
also asphyxiated by the gas, as were the farmer’s wife and two daughters, ages 9 and 11, who each entered the pit in their attempts to save the others.

According to NIOSH recommendations, all manure pits should be properly ventilated and should never be entered unless absolutely necessary. If entry is unavoidable, the atmosphere within the pit should first be tested using a gas monitor and those entering should wear a safety belt or harness with a lifeline tied to a mechanical lifting device that can be operated by a standby person.

Grain bins are also hazardous structures and should be treated as confined spaces requiring entry permits. Safety strategies to prevent engulfment include shutting off and disconnecting, locking out and tagging, or blocking off all mechanical, electrical, hydraulic and pneumatic equipment before a worker enters a storage bin. Employers should also prohibit walking on grain to make it flow, entry onto or below an_Code2_side. Body harnesses with lifelines and proper ventilation and should be treated as confined spaces.

Falls From Height

Field-workers who harvest fruit from trees run the risk of falling from heights greater than 8 ft, as do workers who maintain silos and other buildings. Worker training should include education on hazards associated with working at heights, and employers must provide appropriate fall protection systems. Those who ride horses on farms also face fall hazards. Even when riding a well-trained horse, defective or damaged saddles can cause a rider to slip, and when traveling on uneven surfaces horses can lose their footing.

Sanitation

“Sanitation can often be overlooked,” Wolf says, adding that clean drinking water, sanitation facilities and hand-washing facilities must be provided to all field-workers. The absence of toilets can lead to urinary tract infections due to urine retention and cause workers to avoid drinking, resulting in a greater incidence of heat exhaustion. The presence of hand-washing facilities is critical for preventing infectious diseases caused by microbial and parasitic exposures, as well as reducing chemical exposure for workers who have contact with pesticides.

Ergonomic Risks

Ergonomics in farm work is starting to gain attention and several studies on the subject have emerged. For example, NIOSH is funding a multiyear ergonomics project as well as research on the effects of orchard ladder rung spacing on agricultural workers. Farmers can invest in newer tractors and other machinery equipped with ergonomic mechanisms, such as arm rests or buttons in place of gear shifts.

Repetitive tasks found in fieldwork are now being examined, and employers are putting emphasis on rotating work schedules. “You won’t find an employee doing the same task for more than 2 or 3 hours at a time,” Perez says about the most ergonomically conscious farms.

Additionally, equipment is being developed to reduce the repetition of movements for field-workers. For example, specialized harvest carts allow workers to sit on a low seat and roll forward while picking a row of low-lying vegetables. Similarly, long-handled blueberry rakes and weeding stands for plant nurseries can minimize repetitive bending.

Children in Agriculture

According to EHS Today, more than 1 million children and teens resided on farms in the U.S. in 2009, and on average, 113 individuals under age 20 die each year from farm-related injuries. “Children will always be involved in family farms; the farm is not only a workplace but also often a home and playground,” says Wolf. Awareness of hazards is critical and, according to Laser, too many people believe incidents will not happen to them, especially on family farms where children and parents alike often feel safe due to the familiarity of the environment.

Educating parents is the first step, but children need to learn about hazards as well. One resource for children in agriculture is www.farmsafetyforjustkids.org, a website that provides lesson plans, puzzles and educational resources on many different farm safety topics in both English and Spanish.

Another resource to educate children about agricultural hazards is the Progressive Agriculture Foundation, which governs and secures funding for safety days held in farming communities across the U.S. and Canada. In 2013, 405 events were held for children of various ages, covering topics that included animal safety, chemical safety, equipment safety and grain safety.

“One element we focus on at these events is not just having the child understand risks but also be vigilant for younger children,” says Perez, noting that parents are often busy working and older children need to look out for the safety of younger siblings.

Wolf stresses the importance of age-appropriate training as well as age-appropriate tasking that considers whether the child is old enough to safely accomplish a task. He warns that adults should never let children ride on tractors unless they are equipped with a cab and a buddy seat that safely allows an additional passenger. Additionally, children should never be permitted near manure pits, grain bins and other hazardous locations.

Conclusion

To protect every worker, all safety training, signage and communications must be provided in a language that employees understand. Laser suggests conducting a job safety analysis, in which every task is broken down into steps, to reveal hazards and determine controls. Such an analysis involves every worker and, consequently, makes everyone aware of the risks associated with their particular job.

Whether owning a family farm or managing a large agricultural corporation, those in charge of agricultural operations must seek necessary training opportunities for everyone working in their fields. Standards such as EPA’s WPS and OSHA guidelines can provide a starting point, and current practices should be assessed for additional improvement needs. Most importantly, farm owners must not hesitate to invest in safe equipment, safe practices and safety training. While the money spent on such improvements may seem like a significant cost to a small farm, the safety of workers and children, its most valuable assets, is critical.
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Mind Your P’s & Q’s

According to graphologists, analyzing a person’s handwriting can reveal thousands of personality traits. Take a look at your own handwriting to see how you might be characterized.

**Slant:**
- **Right:** Open to the world, enjoys socializing with others.
- **Left:** Likes to work alone or behind the scenes.
- **None:** Logical and practical.

**Size:**
- **Large:** Big personality, outgoing.
- **Small:** Focused and can concentrate easily. Introspective, shy.
- **Average:** Well-adjusted, adaptable.

**Shape:**
- **Closed-loop L:** Tense, self-restricted.
- **Open-loop L:** Spontaneous, relaxed.
- **Closed-loop E:** Skeptical, resistant to emotional arguments.
- **Open-loop E:** Open mind, willing to try new things.
- **Round S:** People pleaser, seeks compromise, avoids confrontation.
- **Pointy S:** Intellectually curious.
- **Open bottom S:** Not following your heart.
- **Printed S:** Versatile.

Real Simple

Graphology: the study of handwriting, especially in relation to human psychology, as a means of analyzing character.

Palaeography: the study of ancient writings, including decipherment, translation and determination of age.

Diplomatics: a forensic branch of palaeography that seeks the provenance of written, particularly historical, documents.

Forensic document examination: a discipline that examines, compares and analyzes documents to establish genuineness, or identify or eliminate people as the source of handwriting.

Clean Up Your Language

Most PS readers could probably ace a quiz on physical hazard pictograms. But how about these symbols?

- **1:** Machine wash cold
- **2:** Do not bleach
- **3:** Tumble dry medium
- **4:** Line dry
- **5:** Iron low
- **6:** Do not dry clean

American Cleaning Institute

ANSWERS: 1-C, 2-E, 3-A, 4-F, 5-B, 6-D

“Man is a strange animal. He generally cannot read the handwriting on the wall until his back is up against it.”

Adlai E. Stevenson

Mind Your P’s & Q’s

Etc. Etc. Etc.

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