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Title:	Integrating Safety with Science,Technology and Innovation at Los Alamos National Laboratory
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Integrating Safety with Science, Technology and Innovation at Los Alamos National Laboratory

The mission of Los Alamos National Laboratory (LANL) is to develop and apply science, technology and engineering solutions to ensure the safety, security, and reliability of the U.S. nuclear deterrent; reduce global threats; and solve emerging national security challenges. The most important responsibility is to direct and conduct efforts to meet the mission with an emphasis on safety, security, and quality. In this article, LANL Environmental, Safety, and Health (ESH) trainers discuss how their application and use of a kinetic learning module (learn by doing) with a unique fall arrest system is helping to address one the most common industrial safety challenges: slips and falls. A unique integration of Human Performance Improvement (HPI), Behavior Based Safety (BBS) and elements of the Voluntary Protection Program (VPP) combined with an interactive simulator experience is being used to address slip and fall events at Los Alamos.

Slips Simulator provides interactive learning

Slips, trips, and falls are a leading cause of injury at LANL, just as they are across the United States. Many of these injuries occur during the typical winter weather of Northern New Mexico when employees are walking on surfaces covered with ice and snow. The Lab has made various efforts to help alleviate the dangers associated with walking in adverse conditions, including

- purchasing traction footwear for employees;
- placing barrels of deicer material in high-traffic areas;
- repairing sidewalks, stairs, and parking lots; and
- advising workers to wear weather-appropriate foot.

These efforts have not been enough to result in a substantial decrease in slips and falls, so LANL decided to implement Slip Simulators.

The LANL Voluntary Protection Program (VPP) Office researched the use of a slip simulator used by United Parcel Service (UPS) and designed by Virginia Polytechnic Institute and State University. A significant reduction in slip/fall related injuries at UPS has been attributed to the use of this slip simulator as part of their new employee training. LANL is taking a similar approach to address slip injuries and has begun using simulators to teach their workforce how to walk safely on a slippery surface. The objective of a slip simulator is to provide a kinetic learning module ("learn by doing") that has participants experience a slippery surface without the risk of falling due to a built-in fall arrest system. According to VPP Project Leader Bethany Rich, "This experience raises awareness of the importance of walking speed, selection of shoe soles, and placement of your center of gravity."

Joint efforts behind unique safety initiative

"While many improvements have been made by workers and managers to improve our facilities and walking surfaces across the Lab, we will never have a perfect environment," said ESH Integration Office leader Bethany Rich," and as Human Performance Improvement (HPI) reminds us, being human, we will always make mistakes. This initiative offers workers one more tool to help take better care of ourselves and each other."

As more workers were trained on the slip simulators, new and innovative ideas where offered by class participants on how the simulators could be used in additional ways. The Radiation Protection Division saw an opportunity to test several different personal protective equipment (PPE) booties for Radiological Control Technicians (RCT's) to find which booties would provide the most slip resistant soles. This idea got the slip simulator trainers thinking about addressing the needs of other workers who are required to wear PPE that may increase their risk of slips and falls. As a result, LANL's protective force is having all of their workers attend the slip simulator course with all their PPE, and they have altered the distribution of the weight of their PPE to be more balanced, and they practice the drawing of their weapons with the new walking techniques. After coordinating with several groups and developing additional simulator activities, the simulator experience provided a unique opportunity to blend HPI and BBS principles into real life scenarios. Participants who wore PPE on the simulator learned new walking techniques and at the same time, tested walking capabilities with full PPE, emergency response equipment, instruments, helmets and firearms.

In an effort to help sustain the usage of techniques learned during the slip simulator classes, a behavior based safety observation card has been created for workers to use in the field during day-to-day activities in order to give peer-to-peer feedback on notable safe walking techniques, and to convey any at-risk techniques that an observer sees.

After a year of using the Slip Simulators, of the 11,000 workers and contractors at LANL, over 2,500 LANL workers have been trained as either observers or participants on the simulator. LANL has also hosted several DOE contractor sites that are now interested in implementing simulators at their sites: Savannah River, Hanford, Pacific Northwest National Laboratory, DOE-HQ and DOE-LASO. In addition, LANL has hosted external DOE contractors such as our protective force – Securing Our Nation (SOC), the Los Alamos Fire Department, the Emergency Operations Response Team, specialized Spill Teams, and Radiation Control Technicians, all with full PPE. LANL management believes the experience can help take the Lab to a new level of safety performance.

Impact of Slip Simulator Training at LANL

Slip Simulator training started in February 2011 for students in the Hazardous Waste Operations training class utilizing a portable Slip Simulator at the LANL training center. Two permanent Slip Simulators were installed in April of 2011. Two classes are offered and tracked for the Slip Simulator Experience; one is for workers who just observe the class and another for workers who choose to get on the simulator as a participant. The results of the two different populations are compared for the subsequent effectiveness of each.

As of 3/1/12, 2,562 total workers at LANL have completed either the observer or participant Slip Simulator training.

- 913 Participants received verbal instruction and practical instruction on the Slip Simulator (Participant training).
- 1,649 Observers received verbal instruction and watched others on the Slip Simulator (Observer training).

Injury cases involving slipping on slick surfaces at LANL were reviewed for a 12 month period from March 2011 to February 2012. The cases include all visits to Occupational Medicine as a result a “Contributing Factor” or Slip/Trip/Fall, regardless of the accident severity. 147 total Slip/Trip/Fall cases were identified, of which 62 involved falls on ice, snow or other slick surfaces, such as a wet floor.

Of the 913 employees with Participant training on the Slip Simulator:

- 3 fell on a slick surface BEFORE receiving the Participant training
- 0 fell on a slick surface AFTER receiving the Participant training

Of the 1,649 employees with Observer training on the Slip Simulator:

- 1 fell on a slick surface BEFORE receiving the Observer training
- 8 fell on a slick surface AFTER receiving the Observer training

Of the roughly 11,000 workers at LANL, during the 12 month period starting in March of 2011, 62 (0.56%) workers fell on a slick surface. By comparison, 8 (0.48%) of the employees who received Observer training fell on a slick surface after receiving the training. The data seems to indicate that there is minimal benefit from the Observer training, but significant benefit from the Participant training.

Slip Simulator Evaluation Results

After students complete the Slip Simulator training as either an observer, or participant, they are asked to fill out an identical 7 question survey. Below are the results from over 1,000 respondents. Overall, class attendees either agree or strongly agree with all questions except for question #3 (This activity will help reduce my fears about slipping). A significant number of survey responses selected "disagree" on this question, which may indicate that while the class teaches valuable skills, it is not making attendees inappropriately over confident.

Question	Strongly Agree	Agree	Disagree	Strongly Disagree	Total
This activity will help me avoid falling on slippery surfaces.	721	389	20	10	1140
This activity helps to understand safe walking techniques on slippery surfaces.	861	258	7	8	1134
This activity will help reduce my fears about slipping.	531	485	103	13	1132
This activity will help me to identify Slip, Trip and Fall hazards and help prevent fall accidents.	655	438	26	11	1130
If I cannot avoid an unsafe path, I will slow down and take shorter steps.	896	225	5	7	1133
I believe that proper footwear can help reduce my risk of falling on a slippery surface.	924	202	6	7	1139
To me, being safe is as important as getting my work done.	959	153	23	10	1145

Below is a graphical representation of the data in the table above.