



OPERATING EXPERIENCE SUMMARY



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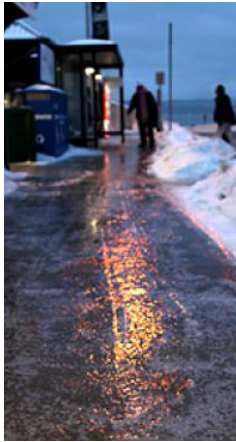
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Winter Safety: Avoiding Slips, Trips, and Falls

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Department of Energy (DOE) sites are located in the four corners of the United States, so winter can stretch from October through April, often catching workers unaware when ice or unexpected winter weather conditions appear. This article discusses weather-related injuries from slips, trips, and falls during winter across the DOE Complex. The article also reviews the benefits of Personal Protective Equipment (PPE) for winter conditions and the successful use of slip simulators. Winter safety messages for workers are also reinforced in the article:

wear appropriate footwear; look ahead—not down—while walking; keep hands free; and stay on cleared and salted paths.

Winter: No Walk in the Park

During the past three winters, the number of weather-related injuries reported to the Occurrence Reporting and Processing System (ORPS) from slips/trips/falls (STF) on ice has remained fairly consistent, as shown in the text box below. Weather-related injuries most often occur while workers go to and from

work, walk between buildings, or perform routine tasks.

Work- and-weather-related STF are reported to ORPS, but each year dozens of other STF result in injuries and lost workdays. These STF with injuries are reported

Number of Weather-Related STF Emergencies

Winter 2012–2013: 12

Winter 2011–2012: 9

Winter 2010–2011: 15

Source: ORPS

in the Computerized Accident/Illness Reporting System (CAIRS). During the most recent winter, more than 20 ice/snow-related injuries, which resulted in more than 600 lost workdays, were reported to CAIRS.

Travel

Unfamiliarity with local weather conditions, combined with travel distractions such as hotel checkouts, appointments, and transportation schedules, make it easier to succumb to weather-related dangers. Two events occurred in winter 2012–2013 when workers were on travel. On March 28, 2013, a Sandia National Laboratory (SNL) worker slipped on an icy sidewalk and fell while on business travel in Denver, Colorado. He had checked out of his hotel with bags in hand and was unable to catch himself when he slipped on ice. As he went down, his right knee hit the concrete. Although the hotel had removed the snow, early morning temperatures hovered at freezing, and the melt/refreeze cycle produced icy conditions at checkout. The injured worker returned to SNL, where site medical personnel diagnosed the injury as a fractured kneecap. (ORPS Report NA--SS-SNL-5000-2013-0001)

Several days later, on April 2, 2013, a Lawrence Livermore National Laboratory (LLNL) worker, who was wearing appropriate footwear (hard-toe boots with aggressive soles), slipped on black ice in a parking lot while on travel at Minot Air Force Base, North Dakota. X-rays taken at a local clinic showed a fractured ulna near the left elbow, but he was released to work with minor restrictions for the rest of the week. He sought additional medical attention on his return to LLNL. Although he had worked in North Dakota before, he may not have been used to a melt/refreeze cycle that presented unseen ice dangers. (ORPS Report NA--LSO-LLNL-LLNL-2013-0010)



Interior Dangers: Wet Floors

Most worker safety programs warn of rainy days and the associated dangers dripping umbrellas and raincoats present. On April 19, 2013, an Oak Ridge National Laboratory worker entered a building and slipped as he stepped from the carpet to the tiled floor, falling down and hitting his knee, wrist, and face. He was stunned, but did not lose consciousness. At the time of the event, there was intermittent rain with enough accumulation to cause “ponding” on the roads, meaning that there was enough rain for pedestrians to track into a building. The worker was wearing suitable footwear and did not think he had stepped in water on his way into the building.

Follow-up investigation determined that two factors outside his control may have contributed to the event. First, more than an inch of rain had fallen that morning, resulting in water being tracked onto step-off mats and tile floors, causing water to accumulate faster than it could be monitored and removed. Second, the umbrella bag dispenser was placed away from the door so that wet umbrellas had to be carried across a step-off mat while dripping. A simple corrective action was taken: move the dispenser to the same side of the entry as the identification/proximity card reader to eliminate one source of water. (ORPS Report SC-ORO--ORNL-X10CENTRAL-2013-0001) The same wet tile floor issue is common during winter months when snow falls off boots and jackets, melts, and presents slipping dangers just at the edges of the step-off mats.

Special Conditions: Field, Essential, and Back-/Night-Shift Workers

Workers who must go off cleared paths to perform work tasks or those who work night/back shifts must make an additional effort to stay upright and safe in bad weather conditions. On March 11, 2013, an Argonne National Laboratory (ANL) worker attempting to collect environmental water samples from wells in a graveled area covered with snow and ice slipped on the ice and fell, impacting her lower back. She drove back to her

office and was taken to ANL Medical for an MRI, which confirmed that she had fractured her sacrum (tailbone). Inspectors determined that *end of life failure* was the direct cause of the accident. Gravel in the area had broken down and settled at a lower grade than the surrounding area, allowing water and snow melt to pool and freeze, which created a dangerous walking surface. Inspectors also determined that the area was not on the annual inspection schedule. Corrective actions included adding the area and other similar sampling locations to the inspection schedule, grading the area to prevent water pooling, and spreading gravel. The event also raised the issue of PPE. Although sampling workers have the option of wearing ice grips on their footwear, such grips may actually exacerbate the potential for twisted ankles and falls when worn on loose gravel; however, they were not worn in this event. (ORPS Report SC--ASO-ANLE-ANLE-2013-0001)

Workers on the night/back shifts, or those who arrive at work early, are especially vulnerable when ice or snow combines with darkness. On January 25, 2013, when icy conditions had closed Y-12 to all but essential personnel, a Security Station Operator slipped and fell while walking on a designated snow route from the parking lot to report for duty at 0500 hours. An ambulance transported him to the hospital, where he was diagnosed with leg and shoulder injuries requiring surgery. The designated route had been treated with brine solution the previous afternoon, but overnight rain had diluted the solution and lessened its effectiveness. As a result, the rain froze when temperatures dropped. An Extent of Condition review concluded that these conditions and injuries could be repeated whenever essential personnel report to work during inclement and changing weather conditions. (ORPS Report NA--YSO-BWXT-Y12SITE-2013-0004)

On February 5, 2011, an Operations Specialist (Ops Spec) at Idaho National Laboratory (INL) slipped on ice at the bottom of an outdoor staircase during evening rounds and injured his

shoulder as he reached to catch himself. He underwent surgery and several weeks of rehabilitation as a result. The Ops Spec had overlooked the fact that changes occur continually—warm, day-time weather had melted the snow at the bottom of the stairs, but dropping evening temperatures caused it to refreeze. Because the stairs were on the north side of the building, nightly icing should have been expected. (ORPS Report NE-ID--BEA-MFC-2011-0005)

On December 6, 2010, an INL worker walking through the parking lot slipped and fell on black ice behind the smoking shack, fracturing his shoulder. The freeze/thaw/refreeze cycle and the location of the smoking shack combined to create the ice danger for unsuspecting pedestrians because snow melt ran off the roof of the shack onto the walking path. Several corrective actions to improve walking conditions were immediately implemented: evaluate the parking lot; apply additional snow melt; replace bulb in outdoor light on an adjacent building and redirect it onto the path; and move the smoking shack to redirect runoff away from pedestrian walkways. (ORPS Report NE-ID--BEA-STC-2011-0002)

PPE for Walking on Snow and Ice

Ice-gripping products such as YakTrax® (Figure 1-1) are useful in maintaining traction while walking on snow or ice. Because they fold down for easy carrying in a pocket, backpack, or briefcase, such grippers can be readily available and should be carried whenever possible. Workers can slip them on over street shoes or even boots when they encounter snowy/icy conditions. However, ice grippers must be removed immediately when the wearer enters a building or reaches dry smooth pavement. On smooth surfaces such as floors, clean sidewalks, or loose gravel, their coiled wire design becomes a danger, exacerbating the potential for twisted ankles and falls.



Figure 1-1. YakTrax®

Success Story: Slip Simulator

Los Alamos National Laboratory (LANL) is a Voluntary Protection Program (VPP) site, but to attain VPP Star status, the site had to reduce injury rates in its top two categories: slips/trips/falls and ergonomics. Past efforts to reduce slips, trips, and falls included providing traction footwear, such as YakTrax® grips for all workers; repairing sidewalks, stairs, and parking lots; reminding workers to wear weather-appropriate footwear; and placing barrels of de-icer in high-traffic areas. However, these efforts did not result in a significant reduction in slip, trip, and fall injury rates.

The LANL VPP office investigated a slip simulator designed by Virginia Tech that the United Parcel Service had used to train its workers and which had significantly reduced slip injuries. Slip simulator training provides the opportunity to practice the learned skills, raising the user's awareness of the importance of length of stride, placement of center of gravity, and walking speed. As a result of its research, LANL purchased three simulators.

A strong business case was made for their purchase, since the cost of just one recordable injury is so high.

Cost of average DOE recordable injury = \$25,000

Cost of slip simulator + installation = \$5,000

How the Simulator Works

A slip simulator provides a kinetic, “learn by doing” module that allows participants to experience a slippery surface without the risk of falling, due to a built-in fall arrest system. Participants begin the training by donning the harness and walking in normal fashion on the slippery surface, with the expected results (i.e., falls). Then, in the training, participants learn to reduce their fall risk by applying the following four techniques.

1. Keep head up—look down with eyes only.
2. Keep shoulders over ankles—don't hunch over or carry things
3. Take half steps.
4. Walk flat-footed, not heel-to-toe.

The photos in Figure 1-2 show two of the slip simulator training exercises.

The simulator raises awareness of how routine behaviors put us at risk for slips, trips, and falls. Rushing to be on time for work, carrying a briefcase or heavy purse, and reading or eating while walking may be routine behaviors, but they are also dangerous ones. Donning PPE may add to the danger because it can change a worker's center of gravity, walking style, or balance.



Figure 1-2. Participants in LANL slip simulator training

Fortunately, workers can be trained on the simulator while wearing PPE such as respirator masks, hazmat suits, and hard hats to help them adjust to the changes that PPE presents. Various LANL organizations also used the simulator to test their activities, such as drawing weapons and withstanding kickback from using firearms (Figure 1-3). Foot coverings were also tested to make more informed procurement decisions based on how items performed on a slippery surface (Figure 1-4).

Statistics

As of spring 2013, more than 3,000 LANL workers had been trained on the slip simulator, and data demonstrated the difference training makes. From March 2011 through February 2012, for example, 62 injury cases involved slips on ice, snow, or other slick surfaces, such as a wet floor.

- Of 8,000 workers who had received no training, 54 workers fell.
- Of 1,800 workers trained as observers (not on the slip simulator), 8 fell after receiving the training.
- Of 1,200 workers trained in participant training (including the slip simulator), *none* fell.

The numbers demonstrate that, simply by observing the training, workers were able to gain awareness of risky walking behaviors and make corrections. The fact that no one who participated in the training was subsequently injured from slips, trips, or falls demonstrates the value of the slip simulator. A presentation about the slip simulator training at LANL can be viewed by clicking [here](#).

Conclusion

Workers at DOE sites may not be able to change the weather, but they can change their responses and behavior when winter weather affects walking surfaces. Situational awareness will enable workers to slow down and stay balanced when they encounter unexpected ice or slippery conditions.



Figure 1-3. Workers trained while wearing PPE and performing special activities such as drawing a weapon



Figure 1-4. Testing foot coverings on slippery surfaces

KEYWORDS: Slip simulator, slips/trips/falls, STF, ice, slippery, melt/refreeze cycle, winter

ISM CORE FUNCTIONS: Analyze the Hazards, Develop and Implement Hazard Controls



The Office of Health, Safety and Security (HSS), Office of Analysis publishes the *Operating Experience Summary* to promote safety throughout the Department of Energy (DOE) Complex by encouraging the exchange of lessons-learned information among DOE facilities.

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