Office of Environment, Health, Safety and Security
Operating Experience Level 3

OE-3: 2014-03 August 2014

Safety Concern: Roll-up Doors

Purpose

This Operating Experience Level 3 (OE-3) document provides information about a safety concern related to roll-up doors that fail unexpectedly, endangering workers. Under normal operation, roll-up doors operate smoothly, and users may not realize the hazard a failed door can present. Industrial doors may weigh more than half of a ton, and uncontrolled gravitational movement is hazardous to personnel and equipment.

Background

Two recent Department of Energy (DOE) events demonstrate the danger of a roll-up door when mechanical failure occurs, but earlier events are a reminder of other potential dangers. Because roll-up doors (such as garage doors) are part of daily life, workers may have a level of comfort that does not translate to the work area where doors are heavier. Roll-up doors used in industrial applications, such as at DOE facilities, are heavier than residential doors and usually are not equipped with an auto-reverse feature that causes them to retract when they encounter an obstacle such as a person or object.

Figure 1: Example of a Roll-up Door Failure

Door cables and springs present additional dangers because they are under high tension. Although these cables and springs require regular checks and preventive maintenance (PM), it is during inspections and maintenance that these parts are dangerous, because they are under extreme residual tension.

The Events

Several events reported to the Occurrence Reporting and Processing System (ORPS) illustrate roll-up door dangers and provide lessons learned.

On May 21, 2014, at the National Renewable Energy Laboratory (NREL), an employee was exiting the central plant of the Field Test Laboratory Building through an open 10-foot roll-up door. He pressed the "down" button and passed through as the door began to descend. As he took a few steps beyond the doorway, the drive sprocket disengaged from the shaft, allowing the door to free-fall closed. The worker was not injured, and the door was immediately de-energized and bolted closed. (ORPS Report EE-GO--NREL-NREL-2014-0025)

Two weeks earlier, on May 7, 2014, at NREL's Energy Systems Integration Facility, an employee pressed the button to activate the roll-up door and stood waiting for the door to ascend to his floor. Just as the 20-foot metal door ascended to approximately 1 foot from the top of the frame, the drive chain jumped the sprocket, allowing the door to free-fall closed. No one was injured, and the door was immediately locked and tagged out of service. (ORPS Report EE-GO--NREL-NREL-2014-0020)

On October 1, 2013, at Lawrence Livermore

National Laboratory (LLNL), an employee engaged the exterior roll-up doors to enter the facility and his designated shop area. The door, which is approximately 26 feet wide and 16 feet tall, opened, reaching a height of approximately 10 feet. After the employee entered the work area, the door's chain broke, and the door dropped more than 7 feet, stopping approximately 32 inches from the floor. The chain also fell to the floor, presenting a potential second hazard. (ORPS Report NA--LSO-LLLNL-LLNL-2013-0042)

On December 14, 2011, at Hanford, a newly installed roll-up door was being opened to receive maintenance equipment and had reached a height of 7 feet. Workers heard an unusual noise (a snap), the door fell to the closed position, and the motor continued to run until a worker pressed the STOP button. No injuries or damage resulted from the event; afterward, power was disconnected and a barricade was set up. (ORPS Report EM-RL--MSC-GENERAL-2011-0010)

On July 11, 2011, at the Savannah River Site (SRS) Salt Waste Processing Facility (SWPF), a 16-foot roll-up door unexpectedly unwound and crashed to the floor during installation. Approximately an hour later, as the door installation subcontractor worked to rewind the door, the door spring unexpectedly released its energy, pinning the worker's hand between his pipe wrench and the door mounting bracket and cutting it badly enough to require surgery. (ORPS Report EM-SR--PSC-SWPF-2011-0004)

On June 14, 2010, at SRS, a Crane Operations Specialist was attempting to open a roll-up door when it made a loud noise and dropped 6 feet to the floor. Although it stayed in its tracks, several parts began to fail, so the operator quickly moved 20 feet away. No one was injured, and the rest of the doors in the facility were tagged out until they could be inspected. (EM-SR--SRNS-SIPS-2010-0012)

Analysis and Observations

Roll-up door failure events reported to ORPS from January 1, 2010 through May 2014, were reviewed to determine common factors and identify lessons learned. Recent events at NREL have led to renewed focus on roll-up door dangers. The facilities/sites took the actions described below.

After the first 2014 event, NREL ordered an extent of condition (EOC) review. All roll-up doors were de-energized and locked/tagged out until further inspections and repairs could be performed. Those inspections identified potential alignment issues in some doors. NREL also improved hazard awareness signage and markings around roll-up doors.

After the second NREL event, a sitewide initiative was taken to either lock/tag out all overhead doors or tape them with *Caution/Danger* tape until they could be inspected. Maintenance initiated and completed inspections of all overhead doors to ensure set screws were adequately tightened and drive sprockets were aligned. A global NREL communication was distributed on May 22, to alert staff of concerns regarding doors and the inspections that were underway. After the inspections were completed, tape was removed and doors were returned to service. A PM subcontractor was hired to immediately begin comprehensive work on all NREL overhead doors.

In the 2013 LLNL event, preventive maintenance had not been performed on the schedule recommended by the manufacturer due to lack of funding. Post-event corrective actions included performing an EOC review to identify other roll-up doors, identify funds to label roll-up door equipment, validate the frequency of PM, and provide a cost estimate for inspecting roll-up doors.

Post-event examination revealed that the motor had not been properly aligned with the sprocket holding the chain, which exerted undue stress on the chain and was not noticed due to lack of periodic maintenance. Conclusion: a motor cannot overcome an improperly balanced door, because the entire system of hinges, track, hardware, and opener works as one. Because of their weight and design, roll-up doors require frequent evaluation and servicing to avoid malfunction and – by extension - possible injuries.

In the 2011 Hanford event, power to the door was immediately disconnected and the area was

barricaded. An investigation revealed that the drive chain master link came apart. As a result, when the chain no longer connected the barrel assembly to the door operator, the door fell. The facility submitted a lesson learned.

In the 2011 SWPF event, after the door initially fell, the subcontractor installer attempted to rewind the door himself. The installer thought he was following the correct steps and wearing adequate protective gear, but he was not aware of manufacturer's warnings about two things: (1) the necessity of using two people to lift and balance the door; and (2) residual energy from springs under extreme tension. SWPF took corrective actions including EOC reviews of doors and brackets and meetings with workers, an overhead door company representative, and supervisors to reinforce the safe procedures.

The 2010 SRS door failure was determined to be the result of age and continuous use. A post-event inspection determined that a contributing factor may have been that the design of the spring made visual inspection impractical during annual preventive maintenance inspections.

These occurrences serve as reminders of the need for regularly scheduled PM, adequate funding to support the PM program, and workers' continual situational awareness. 10 CFR 851, *Worker Safety and Health Program*, incorporates OSHA Standards contained in 29 CFR 1910. 29 CFR 1910.219(f)(3) requires enclosure of sprocket wheels and chains to protect against falling parts if the drive extends over a working area.

Recommendations

The following recommendations for the safe operation of roll-up doors are provided as examples.

- Do not stand or walk under a moving door; wait until it has stopped moving and you are certain it is not malfunctioning.
- Whenever possible, use a "personnel door" instead of walking under a raised door.
- Raise doors to the fully open position, which allows the door to travel to its upper limits and allows the spring to counterbalance the door and hold it in position.
- Keep door in full view and free of obstructions while operating.
- Have appropriately trained rolling-door technicians perform periodic inspections.
- Allow only trained door technicians to install, adjust, or perform maintenance on the doors.
- Maintain awareness when walking or using equipment under or near a door stopped in the "up" position.

References

EE-GO--NREL-NREL-2014-0025, *Near Miss – Roll-up door in FTLB Central Plant Free-falls Closed*

EE-GO--NREL-NREL-2014-0020, *Near Miss – Roll-up Door Free-Falls Closed*

NA--LSO-LLLNL-LLNL-2013-0042, *Building 511 Roll-up Door Near Miss*

EM-RL--MSC-GENERAL-2011-0010, *Roll-up Door Failure at Building 4732A*

EM-SR--PSC-SWPF-2011-0004, *Overhead Door subcontractor Hand Injury During Door Installation*

10 CFR 851, *Worker Safety and Health Program*

"Office of Worker Safety and Health Policy Safety and Health Regulatory and Policy Response Line submission, D14-04-001, *Powered Industrial Door Operator Guarding*" Document

Questions regarding this OE-3 document can be directed to Ashley Ruocco at 301-903-7010 or ashley.ruocco@hq.doe.gov.

This OE-3 document requires no follow-up report or written response.

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