National Safety Council

Case Study

MSD Solutions Lab
an nsc program

Pilot of an Exoskeleton to Reduce Back and Shoulder Injuries

What's the Risk?

Schneider Electric distribution center warehouse workers reported frequent manual handling activities which present a high risk of injury to the shoulder and lower back. One example of a material handling task for these workers is unloading large metal panels from a packing box, which requires a high force lift. Multiple forward bends are also executed to unload accessories from boxes. The combined force and frequency of these movements contribute to a high risk of low back injury to employees. The additional risks of shoulder and wrist injury follows due to employees forcefully grasping (due to the panel weight) the panel with a wide grip (due to the width of the panel) and lifting the panel several inches to clear the container in which it is shipped. Many of these manual material handling activities do not currently have engineering controls that would effectively reduce these injury risks. As such, this led to the exploration of other controls that could lower MSD risk, including the use of exoskeletons.

Implementation of the Exoskeleton

To address the MSD risks associated with manual material handling, Schneider Electric chose to pilot an exoskeleton providing upper body and low back support. Designed to help employees lift heavy items by reducing the load on the lower back by up to 60% while bending, reaching, lifting or stooping, this passive exoskeleton consisted of a harness which was strapped on over the shoulder and down between the legs. It consisted of a series of springs and counterbalance forces and provided mechanical support to employees to assist movement. Implementation was methodical and well documented. A university professor and Schneider Electric's ErgoPlus vendor were involved to ensure that the trial was performed safely and systematically.

To document worker experiences, surveys were conducted prior to the technology implementation, interviews were collected throughout the trial, and a follow-up survey was deployed at the trial's end. These survey responses allowed Schneider Electric to better understand the comfort of the exoskeletons, perceived value, challenges with use or wearing, and other relevant information. Temperature and heart rate were also gathered to determine if the use of the exoskeleton had a negative physical effect on the employee.

The exoskeleton vendor trained the employees on how to wear and adjust the exoskeletons in a hands-on session. Vendor training took approximately four hours and included how to achieve a good harness fit (specific to each individual), an explanation of the exoskeleton mechanism and how it worked, a review of how to use the harness safely, and the importance of reporting fit or use issues. Employees then wore the exoskeletons for a two-week acclimation period on a graduated schedule starting at one hour per day, with frequent check-ins by the onsite staff overseeing the project. This team included the site Safety Manager, Injury Prevention Specialist, and multiple others. Exoskeleton wear time continued to build up per the vendor's suggestion. After this period, employees had a good sense of what the exoskeletons felt like, how they worked and what limitations they had. The two-day pilot to capture data, observe use and gather feedback from the participants then began. Employees were observed, recorded and monitored as they performed the specific manual material handling task of moving the large panels.

Lessons Learned

While the trial was well-thought-out, performed in a well-organized and systematic manner, and had employee buy-in, the data gathered through observation of the task being performed, ergonomic assessment during the process, physical monitoring results and interviews regarding employee experience did not indicate a positive experience or support the utilization of exoskeletons at Schneider Electric. It was determined that this technology did not meet Schneider Electric's needs and did not solve for the risks for which it was intended in the selected pilot. Schneider Electric will focus on engineering controls and proper ergonomic design of job tasks in lieu of less effective strategies such as personal protective equipment (PPE). Yet, the knowledge gained and lessons learned through the implementation and pilot of the exoskeleton were still extremely important.

- Participants perceived the weight of the exoskeleton as heavy (approximately 7 lbs.).
- There was a documented increase in body temperature associated with wearing the exoskeleton and users considered this uncomfortable.
- Leadership recognized each employee would require their own exoskeleton due to hygiene concerns and observation of wear-and-tear experienced after the two-week break-in period.
- Employees who were not as physically fit or had less strength overall had a more difficult time wearing exoskeletons. Several users reported stomach muscle discomfort after just a few hours during both the acclimatization period and the pilot experience.
- Employee feedback indicated that bending over when wearing the exoskeleton required an employee to overcome an opposing force, and when standing up employees reported feeling 'snapped' into position.

    - This rapid ascent presented a potential additional risk of injury to the employees.
- Employees reported wanting to 'fight against' the constraints of the exoskeleton (similar to the experience of wearing a rigid wrist splint) during the conditioning period which resulted in some employees going home sore at the end of the day. By the time the pilot testing was ready to begin, this factor had been overcome by most, based on employee interviews and survey responses.
- Despite being warned during the initial orientation, several participants experimented and attempted to lift items that are outside of Schneider Electric's 26lb lifting limit. No injuries were incurred, but a feeling of invincibility was shown by some wearing the exoskeletons.

Impact and Benefits

- The outcome of the pilot supports the decision to encourage solutions more aligned with the hierarchy of controls, starting with elimination and engineering, and provided data to share with other sites wishing to trial exoskeleton technology. Use of an exoskeleton falls under the lowest category of controls, PPE. Alternatively, an engineering control would be a superior choice to reduce or eliminate the risk. The lure of **"bright and shiny"** technology such as this **is hard to overcome**, but the results of the pilot did not support further experimentation with exoskeleton use.
- Analysis of the manual material handling tasks and effectiveness of the piloted solution helped increase awareness of the risks remaining in manual job tasks.
- Schneider Electric recognizes that, at this time, they will not likely benefit from using exoskeletons for other job tasks, particularly without attempting first to eliminate or reduce the risk utilizing engineering controls.

Schneider Electric

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