HHE Health Hazard® Evaluation Program

Ergonomic and Musculoskeletal Evaluation of Warehousing Tasks at a Logistics Agency in Georgia

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Introduction

Request

Safety management at a logistics agency requested a health hazard evaluation. They were concerned about ergonomics and potential musculoskeletal injuries among logistics employees who performed general warehousing and forklift operations.

Workplace

The facility is part of a large distribution platform that delivers materials globally. At the time of our evaluation, the agency employed about 492 people at this facility. We evaluated employees with various job tasks in five buildings. Employee job tasks included picking, packing, processing, storing, loading, and unloading.

To learn more about the workplace, go to Section A in the Supporting Technical Information

Our Approach

We visited the facility in January 2019 to evaluate ergonomic hazards and musculoskeletal health symptoms of employees. During this site visit, we completed the following activities:

- Observed work processes, practices, and workplace conditions.
- Measured workstation heights and took pictures of workstations.
- Interviewed 43 employees about their work and their health. These included distribution process workers, material examiners, material identifiers, and work leaders. Interview topics included job tenure, job tasks, relevant medical history, and musculoskeletal health symptoms and concerns.

To learn more about our methods, go to Section B in the Supporting Technical Information

Our Key Findings

Most workstations and areas were not ergonomically designed to reduce work-related musculoskeletal disorders

- Most workstations were static and did not adjust.
- Most workstations lacked antifatigue mats and adjustable chairs or stools.

The most common potentially work-related pain reported was in the back and shoulders

- Employees who reported back pain listed job tasks involving lifting, including heavy objects over 35 pounds.
- Employees who reported shoulder pain listed job tasks that included loading and unloading triwall containers and packing items at workstations.

To learn more about our results, go to Section B in the Supporting Technical Information

Our Recommendations

The Occupational Safety and Health Act requires employers to provide a safe workplace.

Potential Benefits of Improving Workplace Health and Safety:

- ↑ Improved worker health and well-being
- ↑ Better workplace morale
- ↑ Easier employee recruiting and retention
- ↑ Improved image and reputation
- ↑ Superior products, processes, and services
- ↑ Increased overall cost savings

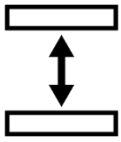
The recommendations below are based on the findings of our evaluation. For each recommendation, we list a series of actions you can take to address the issue at your workplace. The actions at the beginning of each list are preferable to the ones listed later. The list order is based on a well-accepted approach called the "hierarchy of controls." The hierarchy of controls groups actions by their likely effectiveness in reducing or removing hazards. In most cases, the preferred approach is to eliminate hazardous materials or processes and install engineering controls to reduce exposure or shield employees. Until such controls are in place, or if they are not effective or practical, administrative measures and personal protective equipment might be needed. Read more about the hierarchy of controls at https://www.cdc.gov/niosh/topics/hierarchy/.

We encourage the company to use a health and safety committee to discuss our recommendations and develop an action plan. Both employee representatives and management representatives should be included on the committee. Helpful guidance can be found in *Recommended Practices for Safety and Health Programs* at https://www.osha.gov/shpguidelines/index.html.

Recommendation 1: Reduce risks for musculoskeletal disorders

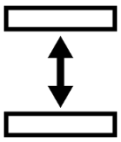
Why? Evidence associates low-back and shoulder disorders with work-related lifting, forceful movements, and awkward postures such as bending, reaching, and twisting. The best way to prevent and control work-related musculoskeletal disorders is through design. Job tasks, workstations, and tools and other equipment should be designed to match the physical capabilities of the employee.

How? At your workplace, we recommend these specific actions:



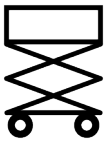
Make sure that hand working heights on conveyors range 38"–49". Also, consider where the employee handles the load, that is, at the top, middle, or bottom of the item.

- Reach distances should range 11"–22".
- Provide tools, such as hooks, for employees to bring items closer without reaching.



Provide workstations that adjust for sitting and standing based on employees' job demands.

- Standing workstations are recommended if the job includes heavy lifting, long reaches, or frequent walking. Adjust these as follows:
    - Standing hand working heights should have an adjustability range between 38"–47" or fixed at 42". The display viewing height (top of screen) should have an adjustability range between 58"–71" or fixed at 66". Viewing distance should have an adjustability range between 18"–30" or fixed at 23".
    - Parts bins used during standing work should be placed in front of the employee. The reaching distance to the bins should be less than 16". The bins' vertical height should be 24"–70".
- Seated workstations are recommended if the job is visually demanding. Adjust these as follows:
    - Seated hand working heights should have an adjustability range between 27"–36" or fixed at 36". The display viewing height (top of screen) should have an adjustability range between 35"–46" or fixed at 46".
    - Seated workstation clearance should be greater than 18" for knee depth and greater than 30" for knee width.
    - Parts bins used during work should be placed in front of the employee. Reaching distance to the bins should be less than 16". The bins' vertical height should be less than 46".
    - A height adjustable chair with footrest can be provided, if needed.



Reorganize stock and place all large items on pallets to make it easier for employees using material handling equipment. Heavy items should be placed on lower racks to make it easier for two-person lifts.

Provide antifatigue mats for employees who usually stand as part of their job.

- Mats should be at least 0.5" thick. They should have an optimal compressibility (firmness) of 3%–4% and beveled edges so they are not tripping hazards. They should be at least 8" under a workstation to keep standing surfaces even.
- Mats should cover the entire area that employees move while performing their job tasks. They should be replaced when they appear worn out or are damaged.

Replace broken chairs. Make sure all chairs can be adjusted and are the right height for each workstation.

Read our recommendations for specific tasks in each building in Section D in the Supporting Technical Information.

Recommendation 2: Get regular input from employees about workplace safety and health issues and use this input to improve work conditions

Why? Monitoring employee concerns, satisfaction, and well-being is useful for finding areas of focus for intervention and improvement. Engaging employees and asking for their input about work builds trust and morale. Employees will feel their input is valued and useful for improving working conditions.

How? At your workplace, we recommend these specific actions:

Use employee input to guide efforts in improving worker safety, health, and well-being.

- Implement an active ergonomics committee that includes management, employee, and union representatives. Effective committees use employee input and experience to help determine work practice and engineering controls.

- Provide a chance for ergonomics committee members to receive ergonomics training. Training could include instructor-led or online classes, as well as training offered at national ergonomics conferences. The purpose of training is to learn about practical, cost-effective workplace solutions.

Recommendation 3: Encourage employees to report health concerns they think are work-related to their supervisors

Why? Recognizing symptoms early can reduce severity. Management can regularly review this information to look for common processes that might be related to reported musculoskeletal health symptoms and safety concerns. Management can use this information to identify opportunities for improvement.

How? At your workplace, we recommend these specific actions:

If needed, employees should seek care for work-related medical concerns from a healthcare provider knowledgeable in occupational medicine.

- The American College of Occupational and Environmental Medicine (https://acoem.org/Find-a-Provider) and the Association of Occupational and Environmental Clinics (http://www.aoec.org/index/htm) maintain databases of providers to help locate someone in your geographic area.

Supporting Technical Information

Ergonomic and Musculoskeletal Evaluation of Warehousing Tasks at a Logistics Agency in Georgia

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Section A: Workplace Information

Employee Information

- The agency employed about 492 people at this facility at the time of our evaluation.
- Employees were members of a union.
- Median employee age was 46 (range: 21–66 years).
- Median job tenure was 6 months (range: 1.5 months–30 years).

History of Issue at Workplace

- Management submitted the health hazard evaluation (HHE) request after a triannual evaluation by their headquarters.
- After the headquarters' evaluation, musculoskeletal disorders (MSDs) were listed as a primary focus area.

Process Description

- The logistics agency was the fifth largest of 26 similar facilities at the time of our evaluation.
- The agency operated on three shifts, with second and third shifts operating with a smaller workforce. We only evaluated first shift, which ran from 6:00 a.m. to 2:30 p.m. Employees did the same job tasks on all shifts. Employees worked eight hours per day, five days per week. Some employees worked Monday through Friday while others worked Tuesday through Saturday.
- The facility consisted of 20 different warehouses. The ergonomic evaluation included six warehouses (Buildings 351, 376, 380, 385, 641, and disposition) where management identified the most ergonomic concerns. The employee health evaluation included employees working in four warehouses (Buildings 376, 380, 385, and 641).
- Employee work activities (job tasks) included constructing wooden crates and boxes; picking, packing, stowing, and processing small (less than 40 pounds) and large (greater than or equal to 40 pounds) parcels; handling large sheet metal; shipping, receiving, handling, and storing metal stock; and office work for property disposal (disposition). Work activities varied by building. Employees reported working in multiple buildings, except for Building 351 (box shop) and disposition workers.
- Receiving tasks included unloading freight trucks manually or using forklifts, which involved lifting boxes of varying sizes and weights. At workstations, employees verified the content of small parcels, ensured the material was packaged properly, and sorted the material to be stored in one of the facility's warehouses or for distribution to another site. Material verification was

also completed on the warehouse floor where bulk or large parcels were placed until verified and sorted. After the material was examined and verified, employees stored material in a designated location within one of the facility's warehouses using material handling equipment (MHE) like stock selectors (if the items were not palletized) and forklifts (if the items were palletized).

- Distribution tasks included locating stored material, picking it from its storage location, packaging the material as ordered, sorting material and placing it in a triwall container, and, if necessary, palletizing material.
- Job task rotation was informal and depended on daily staffing needs.

Building 351

- Construction of wooden crates and boxes.
- Shipping, receiving, handling, and storing metal stock.

Building 376

- Small parcel offloading (unloading), bulk and line receiving, and warehousing (general warehouse duties).

Building 380

- Picking, packing, and stowing large pieces of sheet metal.

Building 385

- Picking, stowing, and packing small parcels, as well as bulk and freight packing.

Building 641

- Packing and processing small items and parcels.

Disposition

- Office work for property disposal.

Section B: Methods, Results, and Discussion

Our objectives were as follows:

- Observe work practices and procedures that may cause MSDs among employees.
- Determine the prevalence of employee symptoms related to work-related ergonomic risk factors.
- Provide recommendations to reduce work-related ergonomic risk factors and MSDs.

Methods: Ergonomics Evaluation

We observed workplace conditions and work practices to identify ergonomic risk factors. We measured workstation heights and reach and viewing distances. We also noted the availability of antifatigue mats and other personal protective equipment. A description of risk factors for work-related MSDs is provided in Section D.

Results: Ergonomics Evaluation

Building 351

Metals employees were responsible for handling, storing, and shipping metal stock. Some pieces were smaller and stored in large vertical shelves (see Figure B1). Other pieces were large and required two employees to handle. Larger items that required cutting were pulled off the shelf with a picker, placed at conveyor height, and slid over to the conveyor saw. During our visit, we saw a multidirectional side loader and a suction lift assist located in this building, though neither were being used. Sheet metal storage, where this equipment could be used, was in Building 380, later discussed in detail.

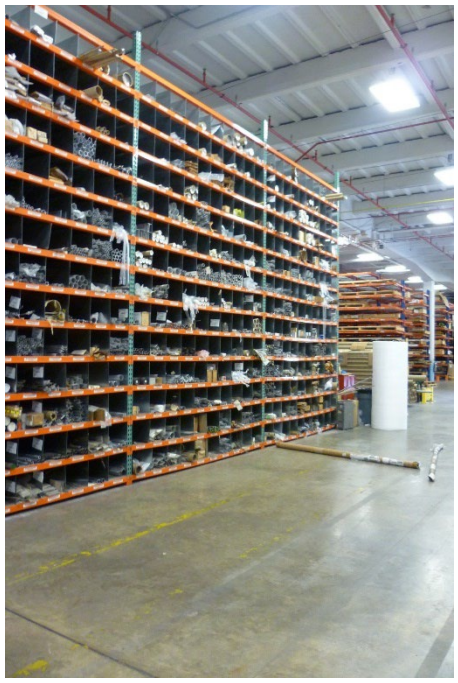

Figure B1. Large industrial, vertical shelves containing metal stock. Photo by NIOSH.

Building 376

Employees were responsible for small parcel offloading, bulk and line receiving, and warehousing. The small parcel offload area had a nonadjustable desk with a working surface at 32.5" and the top of a nonadjustable monitor at 48". The conveyor heights in the small parcel area were 27.5"–34" high. In the bulk receiving area, there were two desks with working surfaces at 32.5" and 33" and monitor heights at 49" and 48", respectively. One monitor was adjustable but limited by a shelf on the desk.

From the receiving area, small items went to line receivers. There were 26 line receiver workstations, but only 10–15 were used at most times. Workstation desks were nonadjustable and set at 32" working surface heights (see Figure B2). The tops of most monitors were located 47.5" from the floor. Conveyors in the line receiving area were set at 31.5". Some of the workstations had adjustable chairs and antifatigue mats. We observed employees working off chairs and extra tables because they ran out of desk space due to the large printers and scales on their desks. There were unused lifts, which could hold triwall containers, located near the conveyors that could be used elsewhere at the facility (see Figure B3).

Figure B2. Conveyors and workstations for small parcel line receiving. Photo by NIOSH.

Figure B3. Unused triwall lift that could be used elsewhere in the facility. Photo by NIOSH.

Small parcels from the line receiving area went to the warehousing area for storage. We noted an unused conveyor perpendicular to the conveyor lines from the small parcel receiving. During our visit, we observed employees pick up boxes from the small parcel conveyor, set them on the unused conveyor, and then walk around to retrieve the boxes to place them in triwall containers used to transport to other buildings. When we spoke with employees, they noted that the unused conveyor was in the way (Figure B4). They suggested rolling carts for their computer and label printer to facilitate their work.

Multiple bulk receiving workstations were scattered throughout the building. All workstations were similar with nonadjustable desks and no pallet lifts to help reduce back strain when working with items on pallets on the floor. Some workstations had broken chairs.

Figure B4. An unused conveyor blocking the pathway between the end of a conveyor line and the triwall container where boxes were placed. Photo by NIOSH.

Building 380

Employees were responsible for picking, packing, and stowing large pieces of sheet metal (see Figure B5). The metal was stored on pallets and moved mostly by forklift. However, if a smaller quantity and not the entire pallet was needed, employees would move the metal by hand. This could require bending at the back to floor level to lift large, awkward, and heavy items. Employees in this area mentioned the need for suction cups or a lift to assist with moving parts. We observed a suction lift assist in Building 351, but most of the heavy material was in this building (Building 380). Some mesh gloves were available to prevent cuts and scrapes, but we did not observe consistent use.

Figure B5. Large pallets holding pieces of sheet metal and boxes. Photo by NIOSH.

Building 385

Employees picked and stowed items using a stock selector. Stock selectors elevated employees to the level of the stock. Some of the stock selector cages were equipped with homemade, temporary workstations, made of wood and/or cardboard, to hold items (see Figure B6). Some of the homemade workstations had antifatigue mats. The small area between the cage and the truck could present a trip/fall hazard when removing items.

Figure B6. Stock selector used to pick and stow items. Photo by NIOSH.

During our visit, we observed seven small parcel (less than 75 pounds) pack workstations. Each workstation was set at about 37.5" from the floor and had a monitor, keyboard, mouse, phone, scanner, printer, and label maker. Monitor heights were about 53" above the floor, and all were nonadjustable. Some of these workstations had antifatigue mats. Each of these workstations had an attached conveyor set at about 30". None of the conveyors had antifatigue mats.

We also observed three bulk/freight pack workstations in this building. The workstations were equipped with similar components as the small parcel pack workstations. Workstations in this area were set at about 32" above the floor, and monitor heights were about 48". Like the small parcel workstations, these were also nonadjustable. Conveyors in this area were set 28"–30" above the floor. We observed no antifatigue mats. Most items in this area were built on pallets. The pallets were on the floor, so employees had to bend at the back to floor level to lift large, awkward, and heavy items.

Building 641

Employees in this building were responsible for preservation, packing, and marking small items and parcels. We noted multiple workstations throughout the building. Workstation heights ranged 30"–36", which put the tops of monitors ranging 44.5"–51.5" from the floor. All conveyors were set at 33.5" from the floor. None of the workstations or tables were height adjustable. As seen in other buildings, pallets were placed directly on the floor, requiring awkward postures when placing and banding items. Some workstations had stools, and others had chairs. Only some workstations had antifatigue mats running the entire area where the employee was required to stand.

Disposition

Employees worked in cubical or office space mainly doing computer work for end-of-life property disposal. Most desks were set at a height of 29.5". Equipment included a chair, phone, computer, monitor (with or without stand), and keyboard (with or without a tray). One workstation had a corner setup with the monitor on a stand and a keyboard tray (see Figure B7). This setup, with the keyboard tray mounted below the desk, did not allow for the proper chair height due to a limitation between the legs and the bottom of the keyboard. This setup also resulted in a monitor height above recommendations and in neck extension (looking up to the monitor) that could cause neck pain/discomfort.

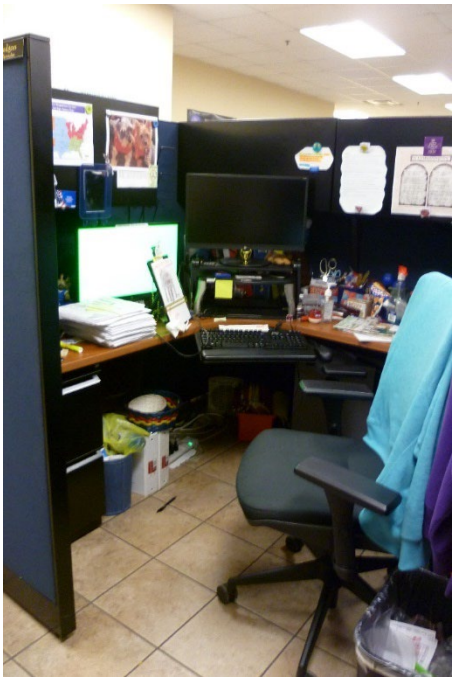

Figure B7. Cubicle workstation with computer monitor on riser, keyboard tray, and chair. Photo by NIOSH.

Methods: Employee Health

Confidential Medical Interviews

We held voluntary confidential medical interviews with employees who worked in Buildings 376, 641, 385, and 380. We interviewed a convenience sample of the about 100 total employees in Buildings 376, 641, and 385. In Building 380, we interviewed all five employees whose job tasks specifically included working with sheet metal. Among the buildings included in our evaluation, working with sheet metal was a job task unique to Building 380. Our team was on site to conduct interviews primarily during first shift, but we also interviewed second-shift employees when our time on site overlapped with second shift.

During these interviews, we discussed job tenure and job tasks, musculoskeletal health symptoms and concerns, and relevant medical history. Employees were asked open-ended questions about musculoskeletal pain experienced during the past 3 months. Employees were also asked an open-ended question about what they thought caused their pain. Musculoskeletal pain was classified as potentially work-related if employees reported that the pain was caused by or made worse by an activity they did at work (e.g., lifting).

Record Review

We reviewed Occupational Safety and Health Administration (OSHA) Form 300 Logs of Work-Related Injuries and Illnesses for the years 2013 through 2018. We summarized entries by year, building, type of injury and activity, and body part affected.

Results: Employee Health

Confidential Medical Interviews

In total, 43 employees participated in voluntary confidential medical interviews. Of the 43 interviewed employees, 20 reported working in Building 376, 14 employees reported working in Building 641, 8 employees reported working in Building 385, and 5 employees reported working in Building 380. Six of the interviewed employees reported working in multiple buildings.

Of the 43 interviewed employees, 36 (84%) were male, and the median age was 46 years (range: 21–66 years). Most interviewed employees worked first shift (n = 38); five employees worked second shift. Interviewed employees reported working in their current positions a median of 6 months (range: 1.5 months–30 years) and reported working for the agency a median of 1.5 years (range: 2 months–30 years).

Interviewed employees represented three distinct job titles: distribution process workers (n = 37), material examiner and identifiers (n = 3), and work leaders (n = 3). Management and employees reported that distribution process workers were qualified to perform most warehouse-related job tasks throughout the agency's warehouses. They performed a variety of tasks, including picking, packing, and stowing material; loading and offloading trucks; operating MHE; and preparing items for distribution. Material examiners and identifiers verified the content of received items and located misplaced materials, but they could also perform the distribution process worker tasks. Work leaders performed the same job tasks as the employees they supervised, but also assigned job tasks, assessed staffing needs, and assisted employees as needed.

Of the 43 interviewed employees, 15 (35%) reported potentially work-related pain (Table C1). The most common sites of potentially-work related pain were the back (n = 7) and shoulders (n = 5). Of the seven employees who reported work-related back pain, all were distribution process workers, and four reported working in Building 376. All employees with work-related back pain in Building 376 reported that their work activities included lifting, and three employees reported lifting heavy items (> 35 pounds). Of the five employees who reported work-related shoulder pain, three were distribution process workers, and four reported working in Building 376. Employees with work-related shoulder pain who worked in Building 376 included work leaders and distribution process workers. Work activities among these employees included loading and unloading material in triwall containers at the conveyor belt, unloading trucks, heavy lifting, and packing material at workstations.

Of the 15 interviewed employees who had ever been diagnosed with an MSD, 14 responded to an additional question about when they were diagnosed. Of these 14 employees, 5 (36%) were diagnosed after starting at the agency. These diagnoses included rotator cuff tear or misalignment, carpal or cubital tunnel syndrome, torn muscle, and an unspecified knee diagnosis.

Record Review

During 2013–2018, there were 99 OSHA Log entries recorded for the site. The number of entries was greatest in 2013 (n = 22) and ranged 13 to 18 entries per year during 2014–2018 (Table C2). During 2013–2018, OSHA Log injuries most commonly occurred in Buildings 385 (n = 18), 641 (n = 16), 376 (n = 11), 351 (n = 10), and 380 (n = 8). All other buildings had fewer than five OSHA Log entries. Musculoskeletal strains, sprains, and pain were the most common type of injury (n = 43), followed by contusions, lacerations, and impalements (n = 20). Injuries were frequently acquired while manually handling material (n = 30); during a slip, trip, or fall (n = 13); or while operating MHE (e.g., forklifts) (n = 10). Overall, entries most commonly addressed injuries involving the upper or lower back (n = 31), hands or wrists (n = 21), or ankles or feet (n = 13). Injuries to the shoulders (n = 8), knees (n = 8), head and face (n = 8), and legs (n = 6) were also reported. Few injuries to the hips, neck, elbow, and arm were reported.

Discussion

Work activities such as extended reaching, bending at the back, lifting items from various levels, and prolonged standing, whether observed by us or reported by employees, could explain the musculoskeletal symptoms, injuries, and disorders that affected employees throughout the facility. Similar activities were listed in incident descriptions on the OSHA Logs. Redesigning job tasks and workstations, as well as decreasing the duration of continuous repetitive movements, such as rotation to jobs that use different muscle groups, are well-accepted measures that should reduce employees' risk for MSDs. Additionally, some studies have shown that small increases in break times have decreased symptoms with no significant effect on productivity [Dababneh et al. 2001; Faucett et al. 2007; Galinsky et al. 2007].

A review of participatory ergonomic processes found that training can be tailored to specific workplace risks and hazards or targeted solutions [van Eerd et al. 2010]. However, reaching goals depends on multiple considerations, such as creating teams with appropriate members (employees, union, and employers); defining team members' responsibilities; making decisions using group consultations; providing ergonomic training; and addressing key factors that could help or hinder the process [van Eerd et al. 2010].

Limitations

This evaluation was subject to limitations. The observations of job tasks were limited to the days when the evaluation occurred. Additionally, we were only able to document concerns and symptoms that were reported to us during our evaluation by current employees who chose to participate.

Conclusions

Most employees with work-related back and shoulder pain reported working in Building 376. These employees reported lifting heavy items, loading and unloading material from triwall containers, unloading trucks, and packing material at workstations. Our ergonomic evaluation identified potential hazards related to these job tasks, including heavy lifting and the double handling required when unloading items from conveyor lines into the triwall container. Reducing heavy lifting (e.g., reorganizing material storage based on weight and size to allow for two-person lifts and facilitate MHE use) and ensuring the appropriate ergonomic design of workstations might reduce work-related musculoskeletal pain among employees.

Section C: Tables

Table C1. Number and percent* of interviewed employees (n = 43) who reported musculoskeletal pain lasting a whole day or more during the last 3 months

Pain location	No. (%) employees reporting pain	No. (%) employees reporting work-related pain
Any pain	21 (49)	15 (35)
Upper or lower back	11 (26)	7 (16)
Shoulders	6 (14)	5 (12)
Legs	5 (12)	2 (5)
Knees	5 (12)	4 (9)
Feet	5 (12)	4 (9)
Wrists	3 (7)	3 (7)
Arms	3 (7)	0 (0)
Hips	2 (5)	0 (0)
Elbows	1 (2)	1 (2)
Neck	1 (2)	0 (0)

* Percentages do not sum to 100% because employees could report pain in more than one location.

Table C2. OSHA Form 300 Logs of Work-Related Injuries and Illnesses, 2013–2018 (n = 99)

OSHA log characteristic	2013	2014	2015	2016	2017	2018	Total
Building*							
385	4 (18)	5 (38)	1 (7)	4 (27)	2 (13)	2 (11)	18 (18)
641	4 (18)	1 (8)	6 (40)	3 (20)	0 (0)	2 (11)	16 (16)
376	5 (23)	2 (15)	1 (7)	2 (13)	1 (6)	0 (0)	11 (11)
351	2 (9)	1 (8)	2 (13)	2 (13)	3 (19)	0 (0)	10 (10)
380	1 (5)	2 (15)	1 (7)	0 (0)	2 (13)	2 (11)	8 (8)
Other	2 (9)	2 (15)	3 (20)	2 (13)	5 (31)	5 (28)	19 (19)
Missing	4 (18)	0 (0)	1 (7)	2 (13)	3 (19)	7 (39)	17 (17)
Type of injury†							
Musculoskeletal strain, sprain, or pain	14 (64)	10 (77)	4 (27)	6 (40)	4 (25)	6 (33)	44 (45)
Contusion, laceration, impalement	3 (14)	0 (0)	3 (20)	4 (27)	6 (38)	4 (22)	20 (20)
Fracture	2 (14)	1 (8)	0 (0)	1 (7)	0 (0)	0 (0)	4 (4)
Other	1 (5)	1 (8)	6 (40)	3 (20)	6 (38)	6 (33)	23 (23)
Missing	3 (14)	1 (8)	3 (20)	1 (7)	0 (0)	2 (11)	10 (10)
Type of activity†							
Manually handling material	14 (64)	6 (46)	1 (7)	3 (20)	4 (25)	2 (11)	30 (30)
Involved MHE	3 (14)	3 (23)	1 (7)	0 (0)	2 (13)	1 (6)	10 (10)
Slip, trip, or fall	2 (9)	2 (15)	1 (7)	1 (7)	3 (19)	4 (22)	13 (13)
Struck by an object	1 (5)	2 (15)	0 (0)	0 (0)	1 (6)	1 (6)	5 (5)
Other	3 (14)	1 (8)	4 (27)	6 (40)	4 (25)	9 (50)	27 (27)
Missing	0 (0)	0 (0)	8 (53)	5 (33)	2 (13)	2 (11)	17 (17)
Body part affected†							
Upper or lower back	8 (36)	6 (46)	3 (20)	6 (40)	5 (31)	3 (17)	31 (31)
Hand and wrist	4 (18)	2 (15)	3 (20)	4 (27)	3 (19)	5 (28)	21 (21)
Ankle and foot	4 (18)	1 (8)	2 (13)	2 (13)	1 (6)	3 (17)	13 (13)
Shoulder	3 (14)	1 (8)	1 (7)	1 (7)	1 (6)	1 (6)	8 (8)
Knee	1 (5)	2 (15)	2 (13)	0 (0)	2 (13)	1 (6)	8 (8)
Head and face	1 (5)	0 (0)	2 (13)	2 (13)	2 (13)	1 (6)	8 (8)
Leg	0 (0)	0 (0)	1 (7)	2 (13)	1 (6)	2 (11)	6 (6)
Other	1 (5)	1 (8)	4 (27)	1 (7)	2 (13)	1 (6)	10 (10)
Missing	1 (5)	0 (0)	2 (13)	0 (0)	1 (6)	2 (11)	6 (6)
Total	22 (22)	13 (13)	15 (15)	15 (15)	16 (16)	18 (18)	99 (100)

* Fewer than five total entries from each of the following buildings: 125, 140, 334, 365, 368, 393, 640, 645, and 1602.

† Numbers and percentages for type of injury or illness, activity, and body part affected may vary because OSHA 300 Log entries allow for listing more than one type of injury or illness, activity, and body part.

Section D: Occupational Exposure Criteria

Risk Factors for Work-related Musculoskeletal Disorders

MSDs are conditions that involve the nerves, tendons, muscles, and supporting structures of the body. They can be characterized by chronic pain and limited mobility. Work-related musculoskeletal disorder refers to (1) MSDs to which the work environment and the performance of work contribute significantly, or (2) MSDs that are made worse or longer lasting by work conditions. A substantial body of data provides strong evidence of an association between MSDs and certain work-related factors (physical, work organizational, psychosocial, individual, and sociocultural). The multifactorial nature of MSDs requires a discussion of individual factors and how they are associated with work-related MSDs.

Strong evidence shows that employees whose job tasks involve high levels of static contraction, prolonged static loads, or extreme working postures involving the neck/shoulder muscles are at increased risk for neck/shoulder MSDs [NIOSH 1997]. Further strong evidence shows job tasks that require a combination of risk factors (highly repetitious, forceful hand/wrist exertions) increased risk for hand/wrist tendonitis [NIOSH 1997]. Finally, evidence shows that low-back disorders are associated with work-related lifting and forceful movements, awkward postures such as bending and twisting, and whole-body vibration [NIOSH 1997].

A number of personal factors can also influence the response to risk factors for MSDs: age, sex, smoking, physical activity, strength, and body measurements. Although personal factors may affect an individual's susceptibility to overexertion injuries/disorders, studies conducted in high-risk industries show that the risk associated with personal factors is small compared to that associated with occupational exposures [NIOSH 1997].

In all cases, the preferred method for preventing and controlling work-related MSDs is to design jobs, workstations, tools, and other equipment to match the physiological, anatomical, and psychological characteristics and capabilities of the employee. Most of the recommendations provided in this report were adapted from principles outlined in *The Handbook of Ergonomic Design Guidelines* [Humantech 2009]. Under these conditions, exposures to risk factors considered potentially hazardous are reduced or eliminated.

Recommendations for specific buildings include the following:

- Building 376
    - Bulk area and small parcel offload: Provide lift tables, load levelers, or stack/band pallets to eliminate placing large items directly on a pallet on the floor.
    - Warehousing: Remove one section at the end of each conveyor line and place triwall containers at the end of each conveyor. This will eliminate the double handling currently required for employees when unloading items from the active conveyor lines into the containers.
        - Provide a mobile computer station or a workspace closer to the conveyors to eliminate additional walking when making labels.
    - Line receiving: Remove triwall lift and tilt devices for use elsewhere.

- Building 641
    - Small parcel area: Remove conveyors where not being used, and provide a workstation table for each employee.
    - Bulk area: Provide lift tables, load levelers, or stack and band several pallets together to eliminate the need for employees to work from a pallet placed directly on the floor.
- Building 351 (metals)
    - Retrain employees to use the side loader to move palletized items directly to the conveyor saw.
    - Provide lift tables or stack/band pallets together to eliminate employees banding items on a pallet placed directly on the floor.
- Building 385
    - Remove containers that were supposed to be temporary.
    - Disconnect the stock selector (yellow cage) from MHEs when unloading items to prevent trip hazards.
    - Create wooden workstation tops for MHEs and remove cardboard (from temporary workstations in selectors).
    - Provide lift tables, load levelers, or stack/band pallets together to eliminate the need for employees to work from a pallet placed directly on the floor.
- Building 380
    - Reorganize stock and place all large items on pallets to make it easier for employees using material handling equipment. Heavy items should be placed on lower racks to make it easier for two-person lifts.
    - Provide mesh gloves to help prevent cuts and scrapes.
    - Provide suction cups for moving metal sheets.
    - Move the multidirectional side loader and a suction lift assist located in Building 351 to this building.
- Disposition
    - Refer to previous recommendations for seated and standing workstations.
        - Provide monitor risers and remove unnecessary shelving.
        - Remove keyboard trays to allow more leg room.
        - Reduce clutter and unused equipment (e.g., printers) from countertops to provide space for keyboards and computer mice.
    - Discuss procedures to request new chairs and sit/stand workstations with employees.

Section E: References

Discussion

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