Garbage Collection

Concern Details

Background:

Garbage collecting requires a worker to retrieve garbage bags from the curb (vertical hand height ~60 cm) and put them into the rear hopper of the truck at a hand height of 125 cm). When retrieving the garbage bags, the worker normally collects one bag in each hand, however on occasion s/he will lift up to 4 bags at a time. If the load is very awkward or heavy, they normally will lift the object with two hands. The average weight of garbage bag is 7.5 kg, with a maximum weight measured up to 39 kg; however, this varies considerably. The worker does approximately 9 lifts per minute, with an average of two bags per lift. The worker often tosses the bags into the hopper instead of walking all the way to the truck. The worker is also responsible for collecting large oversized trash.

Evaluation:

This job is cause for concern for the following reasons:

(1) Some of the population may not be able to perform because it exceeds tabulated strength capabilities.
(2) High back loads that increase risk of injury..
(3) The weights exceed maximum acceptable weight limits.
(4) The bags are outside the accepted lifting zones.
(5) The high lifting frequency may induce fatigue.
(6) Repetitive awkward postures which increase risk of injury.

Ergonomic Assessment

These concerns are discussed in further detail below. Overall, the concerns on this job expose workers to increased risk of injury.

Concern Details

(1) Some of the population may not be able to perform because it exceeds tabulated strength capabilities.

Based on the biomechanical assessment, less than 90 percent of the population has sufficient strength to unload the skids of packages due to the awkward postures and heavy loads [1]. When forces exceed strength capabilities, it hinders an individual's ability to perform the task, and the higher the portion of the population not capable of performing a task, the greater the risk of overexertion injury.

(2) High back loads that increase risk of injury.

The biomechanical human model revealed concern with spinal loading and strength limitations for workers to perform the job [1]. Lifting the bags causes high back compression with the action limit. These high spine loads increases the risk of injury for some of the population.

(3) The weights exceed maximum acceptable weight limits.

The weight of the garbage bags (average 7.5 kg and up to 39 kg plus) contribute to increased risk of injury. The majority of lifts are done with one or more bags in each hand. The weight of a single garbage bag exceeds one handed lifting guidelines of 7 kg [2]. Thus lifting multiple bags at a time greatly exceeds this one handed lifted guideline. Workers are more susceptible to injury if bags exceed 7 kg.

(4) The bags are outside the accepted lifting zones.

This job results in poor lifting conditions which are causes for concern as the location of the bags are outside the preferred lifting zone of 75 cm to 110 cm vertical height and horizontal reach of 40 cm (5^{th} percentile female reach distance with elbow at side of body) [3].

The vertical hand heights to retrieve the bags from the curb are below the minimum vertical hand height and loading them into the hopper is above the recommended hand height.

(5) The high lifting frequency may induce fatigue.

Using a method proposed by the National Institute of Occupational Safety and Health in the USA to create a composite lifting index, lifting garbage bags at a frequency of 9 lifts per minute with a vertical reach of 57 cm results in a frequency multiplier of 0, which results in a composite lifting index score of infinity. A score of infinity suggests the work demands of the job exceeds physiological demands, and thus, increases fatigue and the risk of injury. A score above 1.0 indicates the job poses risk of injury for some of the workforce, and a score over 3.0 indicates high risk of injury to the majority of the population [4].

(6) Repetitive awkward postures which increase risk of injury.

Repetitive awkward postures are caused by the repetitive lifting the garbage bags which are outside the recommended lifting zone. The repetitive, awkward shoulder and back postures which are causes for concern [5].

Furthermore, workers often throw the garbage bags to avoid walking to the hopper. Throwing the bags also results in repetitive awkward shoulder and elbow postures which place the workers at increased risk of injury [5].

Ergonomic Assessment

Awkward postures are much greater during winter conditions when customers put bags on snow banks.

Summary:

Due to these concerns and risk factors, countermeasures are recommended to reduce the risk of developing musculoskeletal disorders when collecting garbage. The following section provides countermeasure recommendations to mitigate the risk of injury.

Countermeasures

Due to the high risk of injury from repetitive, heavy lifting, it is recommended to eliminate the manual lifting of the waste. The ideal solution would be to investigate automated load trucks, with a lifting mechanism to automatically empty large carts called "*toters*". The challenge to this countermeasure is that it involves the community to change to a standard toter, which would be costly. If it is not possible to eliminate the manual lifting via the automatic load trucks, then it is recommended to reduce the load weight and lifting frequency and improving the awkward postures.

Reducing the load weight can be accomplished by ensuring workers lift only one garbage bag at a time. It is also recommended to set a policy which would be communicated to the community to limit the bag weight to 7 kg and notify customers that items will be tagged and NOT collected.

Decreasing the lifting frequency can be achieved by reducing the number of stops for each individual worker. It is also recommended to consider payment by the hour instead of by tonnage or using a "finish and go home" pay scheme that encourages work at excessively fast rates which increases the potential for injuries.

Awkward postures can be improved by communicating with the community on where garbage should be placed, especially in winter months. In addition, trucks with lower hoppers should be purchased.

In addition to the about recommendations, companies should also reference to the Garbage Spec Sheet for things to consider when purchasing garbage trucks.

To reduce risk of injury, garbage collector should following these recommendations:

- Follow good lifting techniques – refer to "Lifting Safety" brochure by THSAO. http://www.thsao.on.ca/

- Move feet to pick garbage and place into truck, instead of twisting the trunk and throwing the load.
- Reduce load weight by ensuring workers lift only one garbage bag at a time.
- Do not lift heavy, awkward loads by yourself.
- Wear appropriate footwear, glove and clothing of the weather conditions.

References

(1) 3D Static Strength Prediction Program (3DSSPP) 6.0.1, University of Michigan.
(2) Eastman Kodak Company. (2004) Kodak's Ergonomic Design for People at Work (2nd Edition) (S. N. Chengalur, S. H. Rodgers, and T. E. Bernard, Eds.) John Wiley and Sons, Inc., New Jersey.
(3) Pheasant, S. And Haslegrave, C. (2006). *Bodyspace: Anthropometry, ergonomics, and the design of work*, Taylor and Francis Group.
(4) Waters, T.R., Putz-Anderson, V., Garg, A., and Fine, L. J. (1994). "Revised NIOSH equation for the design and evaluation of manual lifting tasks." *Ergonomics* 36: 749-776.
(5) Kilbom, A. (1994). Repetitive work of the upper extremity: Part II: The scientific basis for the guide. *International Journal of Industrial Ergonomics*, 14:59-86.