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Peter, Amos ***Ergonomic Analysis of Manual Material Handling of Freights in a Trailer for Shipping***

Abstract

The research was conducted solely to assess the level of employee' exposure to ergonomic based risk factors related to manual material handling by workers shipping department of company XYZ. The study used the Rapid Entire Body Assessment and The Great American Insurance Group ergonomic task analysis worksheet to identify and rate various risks associated with the task of loading a trailer. We also review company XYZ' OSHA 300 injury log to identify the injury pattern to establish a correlation with ergonomics task analysis study. Data obtained and analyzed from the study indicates that there is a high level of exposure of workers to ergonomic risk factor in the shipping department of company XYZ. This was in agreement with OSHA 300 log reviewed in the last study of this research.

The study was able to establish a high level of repetition, overexerting, and assuming of awkward posture linked with the task of loading by employees. The injury log reviewed indicates that over 50% of recorded injuries occurred in shipping. Having analyzed the data, the study recommends various engineering and administrative control measures to eliminate or abate the risk employees are exposed in the loading and unloading of trailers.

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Chapter I: Introduction

In today's ever evolving business environment and unpredictability of human factors, risk analysis in a company could be the key to securing the financial future of the company by ensuring safety of its work force and eliminating unfavorable working condition. There are risk factors associated with an everyday workplace, especially those that has to do with manual material handling in a traditional warehouse setting (Iowa State University, n.d.). Working to minimize employee' exposure using ergonomics principles will in turn increase company' profitability by allowing high level of productivity, quality and efficiency.

Company XYZ is a regional logistics company that is responsible for the management of supply of freights to retail stores in the Midwest region for its parent company. Across two shifts, the company process and transport an average of 130,000 cases a day at the average rate of 8,000 per hour for a period of 16 active hours. The cases vary in weight and dimension, most weighing less than 20lb, however freights weighing 40lb and are common. Cases vary in shape and size. Employees are also required to utilize every available space in the trailer to ensure maximum number of freights to be shipped out. The high volumes of cases, the loading requirement, the speed of the conveyor and the long working hours tend to place an enormous demand on the employees of company XYZ thereby exposing employees to several unsafe working practices including but not limited to repetition, awkward posture, lifting above should height, improper lifting methods and flexing at the waist rather than using their knee joints.

In a study by Howard, (cited in Dalto, 2016), 21% of claims made on work-related musculoskeletal disorder (WMSD) in 2009-2013 are related to overexertion and repetitive motion injuries that are serious enough to result in time off work or disability benefits. Rick Goggins said "Lifting is by far the biggest issue when it comes to WMSDs or 'sprains and strains' in the workplace. There are two lifting problem areas; heavy lifting is the obvious risk and awkward lifts – bending over, reaching out or reaching up to lift objects – are the second biggest problem, even if this is less obvious," (Dalto, 2016)

Laborers, freight, stock and material movers account for the greatest number of days away from work as a result of non-fatal injury with a total of 59,010 days away from work accounting for an incidence rate of 297.8 in 2015 (United State Department of Labor, Bureau of Labor Statistics [BLS], 2016).

A closer look at Howard's work reveals the following, in Howard' study (as cited in Dalto, 2016)

- Injuries to the back, neck and shoulders account for about 2/3 of manual material handling claims.
- The most commonly cited cause of injury was handling a container (25%).
- Among WMSD claims where the injury type was specified,
- 55% were attributed to lifting,
- 17% were attributed to holding, carrying, turning and wielding,
- 14% were attributed to pushing and pulling

From the foregoing, it is easy to see how much of a problem manual material handling is for a warehouse, manufacturing and retail industries.

Company XYZ is a Supply chain logistics and distribution industry averaging 400 employees daily at most times of the year, with the holiday seasons peaking at 500 employees on any given active time of day. The purpose of the study is to provide solution to the challenges facing the shipping department of Company XYZ in manual material handling of loading freights in trailers to be dispatch to its various customers. The task of loading a trailer is mostly performed in an awkward posture and highly repetitive in nature. It exposes the employees to the risk of developing musculoskeletal disorders. The employees are of average height within the ages of 25 to 55 and carry out functions that are outside their power zone i.e. working below waist line and above shoulder level.

Statement of the Problem

The presence of repetition and posture risk factors during the loading of freight at the shipping department of Company XYZ is currently placing the employees at risk of developing muscular skeletal injuries that may directly or indirectly constitute a loss situation for company XYZ.

Purpose of the Study

Considering the various work place stressors that affect the employees operating in the shipping department of company XYZ, this study springs from the need to analyze the operation of loading freights in company XYZ to determine the presence of ergonomic risk factors such as repetitive motion and overexertion in the operational process and proffer treatment for the identified stressors.

The study also analyzed management procedures and safety culture of the company to come up with the desired solution. Employees observation while on duty, documented complains of employees, previous records of various injuries if any, personal interviews and ergonomic assessment of employees' job function using predetermined ergonomic assessment tool and instrument will be the core source of data for this study.

The main reason for undertaking this research was to determine the level of exposure to ergonomics risks by the employees at XYZ Company as they load freights of diverse dimension and weight into the trailers for shipping and storage.

Assumptions of the Study

Before undertaking the research, it was assumed that obtaining information from the managerial team would be a daunting task since company XYZ has an international reputation to maintain and also won't like to reveal data of operation or other practices that are below par for the avoidance of denting the company's reputation. Also, assumptions where made that employees of company XYZ will be able to furnish us with factual and objective information as it regards to how they feel about the current working condition and possible pains they witness while doing their jobs.

Definition of Terms

The following are some of the terms that will be often use in this research. The term and a simple definition or explanation is given below.

Musculoskeletal disorders (MSDs). This are soft-tissue injuries and disorders that causes discomfort and pains to body movement or musculoskeletal system (i.e. muscles, tendons, ligaments, nerves, discs, blood vessels, etc.). Common MSDs include: Carpal Tunnel Syndrome. Tendonitis. Muscle / Tendon strain. (Ergonomics plus, n.d.). They mostly arise as a result of ones work or leisure activity. If work related, they are called work-related musculoskeletal disorders.

Chapter II: Literature Review

The presence of repetition, poor lifting techniques and posture risk factors during the loading of freights into trailers at the shipping department of Company XYZ is currently placing the employees at risk of developing muscular skeletal injuries that may directly or indirectly constitute a loss situation for company XYZ.

In this chapter, various literature as it regards to the stated problem will be reviewed. Some of the literature to review will include: ergonomics as a subject, ergonomics and manual material handling, various ergonomics assessment tools, ergonomic risk factors, ergonomic control measures, muscular skeletal disorders, cost benefit analysis and a summary of what has been reviewed.

Ergonomics

Ergonomics, which can be simply put as the study of the relationship between a worker and his working environment, is a study that tends to facilitate the working condition and environment of workers with the aim of improving workers health and increasing productivity for the organization (Chengalur, Rodgers, & Bernard, 2004). The discipline of Ergonomics as a study, tend to enhance a universal, employee-oriented method to work systems design and redesign that considers the physical, mental, cognitive, environmental, organizational, social, and other relevant factors (Grandjean, 1988; Wilson & Corlett, 1986; Sanders & McCormick, 1993; Chapanis, 1995, 1999; Salvendy, 1997; Karwowski, 2001; Vicente, 2004; Stanton et al., 2004).

Historically, ergonomics (ergon + nomos), or “the study of work,” was originally proposed and defined by the Polish scientist B. W. Jastrzebowski (1857) as “the scientific discipline with a very broad scope and wide subject of interests and applications, encompassing all aspects of human activity, including labor, entertainment, reasoning, and dedication”

(Karwowski 1991, 2001) as cited in handbook of human factor and ergonomics p. 3 by Salvendry 2012. Right from the ancient time of the modern man, man has tried to build complex to sophisticated tools to make work less tedious and this is the very origin of modern ergonomics.

Ergonomics which literally means the law of work, can be broadly defined as "a multidisciplinary activity striving to assemble information on people's capacities and capabilities and to use that information in designing jobs, products, workplaces and equipment" (Chengalur et al., 2004, p. 2). It is a study that is open to facilitating the working condition and environment of workers with the aim of improving their health and increase productivity for the organization. Though a trait of ergonomics can be traced in virtually all discipline, it has been traditionally centered on the effect of work on people. Its' emphasis is on designing methods, equipment and process to reduce fatigue by making the task to fit the worker's capability (Chengalur et al., 2004).

Through a well design job, workplaces, and equipment; ergonomics improve production, health, safety and employees job satisfaction. This is achieved by reducing or eliminating physicality from tasks and/or by reducing psychological and mental demands of a task (Chengalur et al, 2004). The need for increase in production, job satisfaction, and to promote a safe and healthy working place, has given birth to a proportional increase in interest and investment in ergonomics by organization.

Modern day study of ergonomics includes the work of occupational medical physicians, safety engineers, industrial engineers, and many others studying both cognitive ergonomics (perception relative to design, human behavior, decision making processes,) and industrial ergonomics (physical nature of the work environment and human physical and natural capabilities, etc.) (Ergosource, n.d.). The theme of this research is within the ambits of Industrial ergonomics, specifically manual material handling in a distribution warehouse.

Ergonomics and Manual Material Handling

Almost every aspect of modern life involves the principles of ergonomics to simplify tasks but most importantly to enhance the safety and comfort of the persons doing the task. Manual material handling is basically the movement of various tools, raw products, and finish products in a warehouse or any other facility. It can be done with or without aiding tools or equipment. This is a basic industrial process, and as such proper attention should be assign to the employees doing such task. Manual material handling can result to ergonomic injuries as it often involves operators to perform task ranging from pulling, pushing, lifting, and lowering of objects that condition the operator's muscles to an awkward posture that are not neutral thereby exposing the employee to hazardous condition that could eventually result to MSDs. Based on a 2013 data, the 2016 Liberty Mutual Workplace Safety Index identifies overexertion as the number one source of injury in work place. Overexertion injuries arise from the use of excessive force or pressure in manual material handling. They cost American companies over $15 billion in direct workers compensation cost (Copeland, n.d. para. 1)

> Ergonomic as a field of study is heavily related to industrial operations, and knowledge in it can be used to improve working conditions of employees. Safety and Health personnel uses ergonomics principles to determine a safe way of handling materials in a facility to enhance production while lowering cost and significantly decreasing ergonomics risks. Over the last 20 years or so, companies have focused on implementing ergonomics improvement processes with the most successful companies focusing on engineering controls. The use of engineering technology to redesign workplace has paid off as there

has been a significant decrease in cost and incidence of repetitive motion injuries (RMI) by 44% in the last 11 years. Unfortunately, the incidence rate of overexertion injuries has gone down by only 5%, but the cost is on the rise, with an increase of about $700 million a year. (Lotz, 2011, p. 35).

Ergonomic Risk Factors

Categorically, ergonomic risk factors that are associated with the development of musculoskeletal injuries (MSIs) among employees can be put into seven major categories. They are the features of a given work or task that inflict a biomechanical stress on the employee. Ergonomic risk factors are the contributing elements of task that exposes an employee to the risk of MSD hazards. A large body of evidence supported by thousands of laboratory studies, epidemiological studies and elaborate evaluations of the available scientific data by National Institute of Safety and Health (NIOSH) and the National Academy of Science, reveals the listed ergonomic risk factors as the most probably cause of an MSD in the work place (Iowa State University, n.d.):

- Excessive force
- Awkward postures
- Contact stress
- Repetition
- Static postures
- Vibration
- Cold temperatures

“Of these risk factors, evidence shows that force (forceful exertions), repetition, and awkward postures, especially when occurring at high levels or in combination, are most often associated with the occurrence of MSDs. Exposure to one ergonomic risk factor may be enough to cause or contribute to a covered MSD" (Iowa State University, n.d. para. 1).

In almost all cases of musculoskeletal injury, the causative factor can be link to a combination of two or more risk factors.

Jobs with more than one ergonomic risk factors exposes employees to higher risk of MSDs depending on the frequency, magnitude and/or duration of exposure to each. It is therefore recommended that ergonomic risk factors be assessed in light of their collective effect in contributing to musculoskeletal disorders. This is only possible if the job hazard analysis (JHA) and ergonomic risk assessment process involves the identification of various ergonomic risk factors that are likely to be associated with a job (Iowa State University, n.d.).

Though it is easy to identify some of the risk factors in a given task and why they contribute or create a hazardous exposure to MSDs, it will require a painstaking process through the use of ergonomic assessment tools to identify others, as they are not so apparent or easy to identify.

Ergonomics Assessment and Analysis Tools

The detailed analysis of a job by breaking it down into all of its subtasks or subcomponents with the view of identifying problems relating to the performance of the task and providing control measure is a viable tool in ergonomics. Ergonomics task analysis or assessment involves understanding the human performance ability and the design of systems that fits the needs of human users (Annett & Stanton, 1998). The aim of any ergonomic assessment tool is simply identify all those ergonomic risk factors that make the task cumbersome and exposes the employee to MSDs, quantify them, and then make recommendation on redesign of the workplace, ensuring that jobs and tasks are within reach and limitations. The ergonomics task analysis can be broadly divided into four major stages. They include the planning stage, data collection stage, data analysis stage and the Risk reduction state.

There are so many assessment tools to aid a safety professional or an ergonomist conduct a task analysis, but depending on the circumstance, certain assessment tools exhibit advantages over others (Middlesworth, n.d. a). The ergonomic assessment tools evaluate risk levels by quantitatively or qualitatively measuring tasks which allows for an individual to formulate a priority level of activities, identify training needs, analyze possible scenarios, and determine injury risk (Jones, 2011). Most common are The Revised National Institute of Occupational Safety and Health (NIOSH) Lifting Equation, Occupational Safety and Health Administration (OSHA) Ergonomic risk factor screening tool, Liberty Mutual Manual Material Handling Tables also called the Snook Tables, The Washington Industrial Safety and Health Act (WISHA) lifting calculator, The Rapid Upper Limb Assessment (RULA) method, Rapid Entire Body Assessment (REBA) Method, the Great American Insurance Ergo task analysis tool, and the Humantech Ergo continuous improvement approach tool.

The revised NIOSH lifting equation. The revised NIOSH Lifting Equation was developed to identify and evaluate risk factors associated with lifting-based MMH activities in order to reduce the potential for MSDs (Waters, Putz-Anderson, & Garg, 1994). It is a mathematical model put together by NIOSH that helps to determine and identify lifting task that exposes an employee to the hazards associated with MSDs.

The equation considers seven factors to yield a Recommend Weight Limit (RWL). The seven components of the Revised NIOSH Lifting equation are listed as follows, a load constant, horizontal, vertical, distance, and asymmetrical multipliers, as well as the lifting frequency and extent of effective hand coupling (Waters, Putz-Anderson, & Garg, 1994).

The equation that define the RWL is given as follows:

RWL = LC x HM x VM x DM x AM x FM x CM;

Where:

The HM is the horizontal multiplier and is gotten by 10/H where H is the distance from the midpoint of the ankles to the center of the load.

The VM is the vertical multiplier and is obtained by 1-(0.0075|v-30|) where V is the location from the center of the hands in relation to either the lowest or highest point of the lift and the individual's waist height.

The DM is the distance multiplier and gotten by 0.82 + (4.5/D) where D stands for the height travelled by the load to get to the destination.

The Avis the asymmetrical variable and can be determined by 1-(0.0032A) where A accounts for spinal rotation during the lift in degrees.

The asymmetrical multiplier is the largest angle of spine rotation during the beginning and ending phases measuring from the center of the hands to the midpoint between the ankles. The frequency multiplier is the rate the task is performed on a per minute basis with regard to work duration and vertically distance travelled. A frequency multiplier value is determined through a table which requires the work duration and V variable. The work duration is separated into three time phases an individual is performing the task which includes less than one hour, one to two hours, and two to less than eight hours. Furthermore, the time phases of the work duration are separated into two portions based on the V value which includes less than 30 or greater than 30 inches. Utilizing the work duration and V value in conjunction with the frequency, an individual is able to determine the score through the use of the previously mention table. The last multiplier of coupling refers to the adequacy of the handles which is evaluated as being either “good”, “fair” or “poor”. An object with a good coupling-based handle incorporates handholds which allows a worker to comfortably grasp the object. This may include an object’s handles that are between 0.75 to 1.5 inches in diameter and with a length of 4.5 inches or greater. In addition, if hand cut outs such as the ones utilized on the side of corrugated boxes are provided, the dimensions must allow for clearance of a hand to comfortable fit through the opening. The physical dimensions of the object must be less than 16 and 12 inches in the frontal length and height, respectively.

Furthermore, the object must incorporate a non-slip surface to minimize the container from being dropped. A fair coupling is an object without handholds or with handles exceeding the previously mentioned dimensions. In addition, a coupling may be classified as fair if the fingers are able to be flexed in a 90° position. A poor coupling is defined as one that is lifting non-rigid objects which are bags that contents move within the packaging. Multiplying the aforementioned variables together results a recommended weight limit which is an acceptable load weight that most individuals may lift (Waters, Putz-Anderson, & Garg, 1994). The resulting RWL is utilized in the Lifting Index (LI) equation which compares the actual weight of the object being lifted against the RWL.

The result from the LI provides a numerical value to represent an estimation of the physical stresses associated with a task. A task that produces a value equal to or greater than one implies the presence of moderate ergonomic risk. Included within the manual of the Revised NIOSH Lifting Equation are recommendations based on the numerical results. The LI can be used to evaluate how physically stressful a give task is to an employee. The greater the value of the Lifting Index, the lesser the fraction of workers capable of carrying out the task in a safe and sustaining manner. The LI can also be use in the design and redesign of work station.

However, the Revised NIOSH Lifting Equation cannot be utilized where a one-handed lift is performed, lifting/ lowering-based work is performed over eight hours, lifting occurs while seated or kneeling, and unstable loads are handled which may shift during transit (Huynh, 2014).

Rapid Entire Body Assessment. The REBA as the name implies, systematically analysis the entire body posture and ergonomic designs risk associated with a given job task. The basic concept of the REBA is to assign a predetermine score for each posture during a job function and using that to determine the level of risk associated with a task base on a single score generated from the various variables. The score generated, which ranges from 1 to 11, will then be used to determine the level exposure to MSDs of given task. Body posture, forceful exertions, repetition, type of movement, type of action, and coupling are evaluated from a single page form. Each body region involve in the task is assigned a score, the score is analyzed to generate a single value which is then used to determine the level of risk exposure (Middlesworth, n. d.(a)).

Rapid Upper Limb Assessment. The RULA is a diagnostic tool use to analyze the biomechanical and postural force requirement of a given job task on the trunk, neck and upper body extremities. Like the REBA, it's a single page form used to evaluate required body posture, force, and repletion in a task. As with the REBA, the RULA compiles each of the body segment scores into tables to determine a total value for the section. The total values from the body segments are adjusted by adding a muscle use and load scores to determine a final risk level for the task. The final risk level score varies from 1, an acceptable posture to 7, which means to investigate and implement change. The higher the risk level, the greater need to investigate and implement controls to diminish ergonomic-based hazards associated with the task. The RULA is preferred for sedentary tasks that utilize the upper extremities such as assembly line work where the worker is in a seated position (Jones, 2011).

The Snook tables. Also called the liberty mutual material handling table, is the research product of Dr. Stover Snook and Dr. Vincent Ciriello. The Snook Tables provide both male and female population data and indicates whether such groups are capable of performing MMH tasks without experiencing negative effects such as overexertion (Liberty Mutual Insurance Group, n.d. para. 1). The tables contain certain weight values generated from several experiment values for specific types of job tasks that are considered to be tolerable to a defined percentage of the population doing the task (Middlesworth, n.d.(a)).

When utilizing the Snook Tables, one must abide by the guideline that a minimum 75% female work population should be considered to diminish the likelihood of musculoskeletal straining or whole-body overexertion. The tables are characterized by the height at which lifting heights start and ends, forces and distance required during pulling, carrying, and pushing tasks, as well as the frequency of the task. For example, a lifting task that has employees lifting an object above shoulder level will use the Tables 3M and 3F to determine the population percentages capable of performing the activity (Appendix D). Although, the tables provide data on multiple MMH tasks, spinal rotation and spine flexion are absent from consideration due to those actions placing additional physical stress on the vertebrae and disks. The Snook Tables provides information that other assessment tools relinquish such as one-handed carrying and human body measurements (Ellis, 2010).

Task for males and females should be designed to accommodate at least 75% of the female population (Snook, 1970, NIOSH, 1981). By doing so, the task will automatically fit or accommodate at least 90% of the male population assigned to the job. It is highly recommended to redesign any task that cannot accommodate at least 75% of the total population and such task should be considered for MSD prevention control (Middlesworth n. d.(a)).

Ergonomics Work Place Control

After the evaluation and analyzing of a task and or a given work station or environment, the safety and health professional will come up with a treatment plan or control to eliminate or alleviate the risk present in given task or job function. There are three major source of workplace controls. In the order effectiveness in mitigating risk factors, they are, Engineering, Administrative and the use of personal protective equipment.

Engineering controls are the most effective method to mitigate risk factors by designing or modifying the workstations, tools and equipment, or the environment (Chengalur, Rodgers, & Bernard, 2004). Designing workstations should be based on the approach of minimizing the use of physical strength or effort of the worker, such as reducing the worker's horizontal and vertical distance from the work (Grandjean, 1988).

The engineering control. When elimination of the risk is the aim and when it is possible to do so, engineering control is mostly use and it is the preferred from the hierarchy of control. It is the most preferred control measure when working to reduce or eliminate a certain work place risk. The engineering control focus on the type of hazard present and work to eliminate the hazard. The principle idea behind engineering control is to design the job environment and the job to eliminate any potential hazard or reduce exposure to hazard as feasible as possible.

Engineering controls are based on the following broad principles:

1. The design or redesign of a facility, equipment or re plan the process in other to eliminate the risk of MSDs exposure or by substituting an equipment, process or facility with not or less hazardous to the worker (OSHA Academy, n.d.).

2. In a situation where design to eliminate is not possible or feasible, the use of materials or other substances to enclose the hazard to prevent or restrict exposure in normal operations (OSHA Academy n.d.).
3. Where neither of eliminating or enclosing the hazard or exposure source is not feasible or possible, barriers should be established or localization of ventilation to reduce exposure to the hazard in normal operations (OSHA Academy n.d.).

Administrative control. Occasionally, engineering controls are too expensive or difficult to initially implement and thus supplementary efforts such as administrative controls are required (OSHA, n.d.). Administrative controls include procedural practices such as proper lifting techniques, team lifting, job rotation and enlargement, and production scheduling. Training workers on the proper lifting techniques is a technique to increase awareness of the negative effects MMH activities cause. (Holmes, Lam, Elkind, & Pitts, 2008).

Administrative control involves the use of safe work practices, procedural practices and manipulation of work schedules to reduce employees' exposure to hazard. They are used together with engineering controls aim at reducing or eliminating the hazard. Administrative controls don't eliminate, but only manage to limit the exposure of the employee to the hazard or limit the frequency of occurrence.

Personal protective equipment (PPE). PPE is the least effective measure for controlling work related risk factors as well as hazards and caution should be taken for the implementation of such programs (NIOSH, 1998). When it becomes difficult to eliminate a hazard from normal operations or maintenance work through engineering method, and when safe work practices cannot give the needed extra protection from exposure, PPE may be required (OSHA Academy n. d.). PPE is the least effective of the various control measure as it provides a protection against the hazard while still working in a hazardous environment. Though cheap at first in controlling hazard, but it happens to be expensive on the long run because of their disposable nature and recurrence expenses.

PPE includes such items as; Steel toed boot, Safety Glasses, Hard hats, Life jackets, Ear plugs, Respirators, Harnesses, Knee guards, Hand gloves and many more.

Musculoskeletal Disorders (MSDs)

MSDs are disorders and injuries that inflicts soft tissue occasioned by a combination of two or more ergonomic risk factors such as sudden or sustained exposure to excessive force, repetitive motion, temperature extremes, vibration, and awkward positions. Soft-tissues affected include, the tendons, cartilages in various parts of the body, muscles, joints, and nerves (NIOSH, 2017). They affect the human body's movement or musculoskeletal system in general and causes systemic difficulties in addition to the localized effect (Ergonomic plus n. d., American Chiropractic Association, 2014). MSDs have been a major problem for individual and organizations across the country as they constitute a key financial burden in direct and indirect cost in running a business. Data from the Bureau of labor statistics claim that MSDs are constitute the largest group of work places injury and are responsible for over 30% of all compensation cost claimed by workers.

Common examples of MSDs include the following (Ergonomic Plus):

- Carpal Tunnel Syndrome
- Tendonitis
- Muscle / Tendon strain
- Ligament Sprain
- Tension Neck Syndrome

- Thoracic Outlet Compression
- Rotator Cuff Tendonitis
- Epicondylitis
- Radial Tunnel Syndrome
- Digital Neuritis
- Trigger Finger / Thumb
- DeQuervain's Syndrome
- Mechanical Back Syndrome
- Degenerative Disc Disease
- Ruptured / Herniated Disc

MSDs in the work place are most caused by the various ergonomic risk factors earlier outline in this chapter i.e. excessive force, repetitive activity, duration of task, extreme temperatures and postural stress. Exposure of an employee to any or combination of this ergonomic risk factors for a long duration of time will lead to the development MSDs. Employees' susceptibility to MSDs can be influence by the personal life style of the employee. In addition to the crucial role the design of a workplace plays in exposing employees to MSDs, the personal life style and work ethics of an individual also contribute significantly to the level of exposure and susceptibility of an employee. Individual or personal risk factors are those associated with the life style of the employee performing such job function. This could be poor work practices, poor health habit and poor fitness of the individual.

Work-related risk factors. How a workplace is design is the most significant factor in determining the number of ergonomics risk factors to be associated with the task. They design plays a major role in exposure of an MSDs. When a job or task is designed to be perform by workers outside their limitation and capability, it invariably exposes the employee to MSD risk (Middlesworth n. d.).

There are three primary ergonomic risk factors (Middlesworth, n.d. para. 4-6),

High task repetition. Many work tasks and cycles are repetitive in nature and are frequently controlled by hourly or daily production targets and work processes. High task repetition, when combined with other risks factors such high force and/or awkward postures, can contribute to the formation of MSD. A job is considered highly repetitive if the cycle time is 30 seconds or less.

Forceful exertions. Many work tasks require high force loads on the human body. Muscle effort increases in response to high force requirements, increasing associated fatigue which can lead to MSD.

Repetitive or sustained awkward postures. Awkward postures place excessive force on joints and overload the muscles and tendons around the effected joint. Joints of the body are most efficient when they operate closest to the mid-range motion of the joint. Risk of MSD is increased when joints are worked outside of this mid-range repetitively or for sustained periods of time without adequate recovery time.

Exposure to these workplace risk factors increases the level of MSD risk of an employee. "Its common sense: high task repetition, forceful exertions and repetitive/sustained awkward postures fatigue the worker's body beyond their ability to recover, leading to a musculoskeletal imbalance and eventually an MSD" (Middlesworth, n.d. para 8).

According to NIOSH/ U.S Department of Health and Human Services,

> A substantial body of credible epidemiologic research provides strong evidence of an association between MSDs and certain work-related physical factors when there are high

levels of exposure and especially in combination with exposure to more than one physical factor (e.g., repetitive lifting of heavy objects in extreme or awkward postures). The strength of the associations reported in the various studies for specific risk factors after adjustments for other factors varies from modest to strong. The largest increases in risk are generally observed in studies with a wide range of exposure conditions and careful observation or measurement of exposures. (Bernard P. B, 1997 (ed))

Individual-related risk factors. An individual personal life style together with work related risk also contributes to the risk of MSDs. A person's daily life activity other than work, such as sports and housework, could also constitute stress to the soft-tissues of the body. The risk imposed by an individual life style is depended on other factors such as gender, socioeconomic status, age and ethnicity. Others risk factors also suspected to influence MSDs include obesity, smoking, muscle strength and other aspects of work capacity (Journal of Electromyography and Kinesiology).

Individual risk factors include (Ergonomics Plus):

Poor work practices. Workers who use poor work practices, body mechanics and lifting techniques are introducing unnecessary risk factors that can contribute to MSDs. These poor practices create unnecessary stress on their bodies that increases fatigue and decreases their body's ability to properly recover.

Poor overall health habits. Workers who smoke, drink excessively, are obese, or exhibit numerous other poor health habits are putting themselves at risk for not only musculoskeletal disorders, but also for other chronic diseases that will shorten their life and health span.

Poor rest and recovery. MSDs develop when fatigue outruns the workers recovery system, causing a musculoskeletal imbalance. Workers who do not get adequate rest and recovery put themselves at higher risk.

Poor nutrition, fitness and hydration. For a country as developed as the United States, an alarming number of people are malnourished, dehydrated and at such a poor level of physical fitness that climbing one flight of stairs puts many people out of breath. Workers who do not take care of their bodies are putting themselves at a higher risk of developing musculoskeletal and chronic health problems.

Cost Benefit Analysis

In determining the feasibility of workplace controls, a cost-benefit analysis (CBA) may be performed to understand the financial obligations associated with a solution. A CBA illustrates the solution in terms of monetary value which includes direct costs associated with injuries. However, certain CBA tools such as the calculator developed by Washington State Department of Labor and Industries and the Puget Sound Human Factors and Ergonomics Society (PSHFES), examines the indirect costs associated with injuries as well. The Washington State and PSHFES CBA calculator utilizes data regarding the average MSD losses as a basis to estimate the return on investment with proposed ergonomic solutions. As an alternative to using the average MSD costs within the Washington State CBA, one may input actual losses experienced by the organization or input potential injuries based on the risk factors previously identified by the ergonomic assessment tools.

To utilize the Washington State and PSHFES CBA calculator one may enter the type and quantity of reported MSDs into the “Worker’s Comp” tab which provides an estimated total cost. The estimated total is based the average annual MSD claim and indirect costs which may be used to effectively demonstrate the current financial commitment (Goggins, 2012). Utilizing the estimated total in the "Input Solutions" tab allows an individual to input three possible ergonomic solutions which account for costs associated with the intervention such as materials, training, and reoccurring requirements. Furthermore, the "Input Solutions" tab examines the effectiveness of the solution through the elimination or reduction of exposures as well as accounting for potential productivity improvements. The inputted data from the "Input Solutions" tab is used to determine the monetary value in the "Benefits" tab which illustrates the return on investment.

In addition, the Washington State CBA calculator represents the information in a graph and table format to easily justify solutions to management (Goggins, 2012). Thus, CBA tool similar to the one which was developed by the Washington State Department of Labor and the PSHFES is utilized to cost-justify proposed ergonomic solutions for implementation by accounting for the direct and
Indirect costs associated with MSDs.

Summary

Ergonomics as a study is concern with determining the relationship between the worker and his work environment with the view of improving the work environment to accommodate the workers ability so as to ensure comfort while at the same time improving productivity. It has developed over the years to cover almost every field of study. This research is mostly concern with the job of employees in the shipping department of company XYZ. Considering the various ergonomic risk factors discussed in this chapter, it is most likely that employees of company XYZ are at the risk of developing MSDs which is likely to cost the company a lot in dollar amount and lost hours.

Various assessment tools have been outlined and discussed that will aid in the determination of the presence of any ergonomic risk factor in company ZYX. Possible control methods ranging from engineering control to the use of PPE has also been discussed to give the company an insight of what need or might be done to improve the working condition of its employees in the shipping department.

Chapter III: Methodology

The purpose of conducting this study was to analyze manual material handling operation in company XYZ in an effort to determine the presence of ergonomic risk factors such as repetitive motion, improper lifting techniques, awkward posture and overexertion in the operational process of loading a trailer and proffer treatment for the identified stressors. The employees of company XYZ are the focus of this study. The entirety of the research is done in the premises of company XYZ and its employees are the subject of the research.

This is a dedicated chapter to discuss the modalities of the study, the instrumentation, methods and procedures use in data collection and analyzation, limitation of the research methodology and the subject and selection i.e. the target population.

Subject Description and Selection

The target population of this research was drawn from the shipping department of Company XYZ and are often referred to as the loaders. The primary duty of the employees this study target at is to load freights in trailers as conveyed from the shelves of a warehouse containing over two million freights of various dimension and shape. The height of the conveyor is relatively constant. However, freights are stack from the floor of the trailer to the ceiling of the trailer with an expected 10inch allowance. As earlier stated, freight weight varies considerably, with some weighing as much as 50 pounds. The study was conducted at the time of the year when the company usually experiences its highest volume of order, hence the busiest time for the employees of Company XYZ in the unit the research was conducted. There are over two to five million items spread across the entire warehouse and an average of 10 thousand freight are conveyed per hour to employees in the trailers to stack. The period of the research which coincided with one of the company peak seasons of the year made it difficult to get most employees to make out time for the questioning and assessment. When we eventually made it for the data collection, we first make sure that a subject consent form was developed, issued to them and signed. The form stated that all participation was voluntary and that all data acquired will be kept in strict confidentiality, assuring them that no subject identity will be revealed during or after the study. It also stated that all records from the research were confidential, securely stored and destroyed once the study was concluded.

Some management staff employees were also interviewed. They include supervisors and coordinators of warehouse and safety director. The management team's involvement was to offer insight into policy making within the company as regards employees safe working conditions.

Instrumentation

The instruments used to ensure proper and accurate data collection for this study include measuring tape, force gauge, video recorder, goniometer and a computer with spread sheet. The REBA and the Great America Insurance Group (GAIG) worksheet are the ergonomic assessment tools employed to assess the potential ergonomic risk employees of company XYZ are exposed to. The tools were selected because of their comprehensive and quantitative screening method that considers the entire body of a subject in the assessment process.

This REBA assessment tool employs a methodical procedure to appraise the entire body exposure postural MSD and ergonomic design risks connected to a given job tasks. It consists of a one-page form which has criteria to appraise various body posture, repetition, forceful exertions, body movement, repetition, and coupling. The concept is to assign a ranking in number to various body parts involve in a given job task. These parts include: wrists, forearms, elbows, shoulders, neck, trunk, back, legs and knees. After scoring the various body parts, variables representing risk factors are compiled and use to generate a single score that represents the level of MSD risk. The exposure scores according to REBA were given as four (0, 1, 2, and 3) exposure categories which represent negligible, low, medium and high respectively. The GAIG worksheet applies the same principles as the REBA, however GAIG worksheet put into consideration both quantitative and qualitative tasks.

Data Collection

Data was collected for this study through the following procedures:

- A measuring tape was used to measure the vertical distance of the conveyor from the trailer floor.
- Video recording of employees on active duty was made. The video was later watched and analyzed to determine various body part movement and posture
- A goniometer was used to measure the angles of movement of various parts of the body while doing active work as seen in the video.
- A force gauge was used to determine the force required to retrieve different boxes of freights from the conveyor system
- Previous baseline injury data were collected from Company XYZ to analyze employee's injury rate in the shipping.
- The data collected was then analyzed and applied to the ergonomics assessment tool chosen for the study.

Data Analysis

All data collected for the study was analyzed using the REBA and GAIG ergonomic assessment tools. The assessment generates a single digit number which corresponds to the level of exposure of employees to MSD risk in the shipping department of Company XYZ.

Findings and results obtained where analyzed, and recommendations made in Chapter 5.

Limitations of the Study

The following were limitations faced throughout the research:

- The study coincided with the busiest time of the year for Company XYZ. This made it difficult having detail conversation and communication with the employees as they all seems to be very busy.
- The study's findings and recommendations are only applicable to XYZ Company.
- REBA and GAIG ergonomics assessment tools are only primary screening tools

Chapter IV: Results

The research was aimed to identify and analyze the ergonomic risk factors that may be associated with manual material handling of freights in trailers for shipping. The goal of the study was to perform an ergonomic task analysis to identify various risk factors associated with the manual material handling of freights in the shipping department of company XYZ. The study also analyzed previous injury record of company XYZ to understand the trend of injury in the company' existing records. Data in this research was compiled mainly from participants observation, video recordings, pre-existing company' OSHA records and the use of questionnaire. The research applies the Rapid Entire Body Assessment (REBA) and the GAIG task assessment worksheet techniques to determine the risk level associated with the task assigned to shipping staff during the process of observing the participant.

The primary purpose of the study was to perform an ergonomic task analysis for the loading of trailers with freights of diverse shape and dimension for shipping in company XYZ. The REBA and the GAIC ergonomics task analysis worksheet are the ergonomic assessment tools employed in this study to generate data for the assessment process for workers in the shipping department of company XYZ. Other goals of the research include, review of the company' OSHA 300 log to find any correlation with the assessment in terms of injuries and occurrences that are related to ergonomic risk exposure.

Rapid Entire Body Assessment (REBA)

The REBA as the name implies, systematically analysis the entire body posture and ergonomic designs risk associated with a given job task. The basic concept of the REBA is to assign a predetermine score for each posture during a job function and using that to determine the level of risk associated with a task base on a single score generated from the various variables. The score generated, which ranges from 1 to 11, will then be used to determine the level exposure to MSDs of given task. Body posture, forceful exertions, repetition, type of movement, type of action, and coupling are evaluated from a single page form. Each body region involve in the task is assigned a score, the score is analyzed to generate a single value which is then used to determine the level of risk exposure (Middlesworth, n. d.).

Data Presentation

This section discussed the data collection process and analysis of the work station using some of the various ergonomic analysis tools earlier discussed. The analysis process was discussed in line with the objectives of the research.

The primary objective of the research was to perform an ergonomic task assessment on the workstation utilizing the Rapid Entire Body Assessment (REBA) (see Appendix A) to determine certain risk factors associated with the loading process in company XYZ. REBA assessment tool was employed by the research team to quantitatively analyze various body parts regularly used to perform the associated task. Body parts analyzed using the REBA ergonomic tool in upper and lower arm, wrist, legs, trunk, head and neck. Th force, ease of lifting or picking a load, static posture and repeated movements were all considered to calculate the final REBA score. With help of a pre-recorded video, various body parts of the employee were analyzed critically to identify all associated risk in the loading process. Angles of flexion and deviation was determined with the help of a simple goniometer in conjunction with the video recordings.

Table 1 and 2 below displays the score for each posture observed by the different body parts and the final REBA score obtained for the analysis:

Table 1

REBA Assigned Scores by Body Part and Action

Body Parts	Posture	REBA Score
Neck	20° Neck flexion	2
Neck Twisted	Neck Twisted Right and Left	+1
Neck Score	20° Neck Flexion and Twisting	3
Trunk Position	Forward Bending and Twisting	3
Legs	Legs well Supported on Platform	1
Wrist	Flexion of >45°	3
Upper arm	Shoulder > 90 degrees, abducted	6
Lower arm	Above Body Midline	2

Table 2

Final REBA Score of the Loading Process

Body Part	REBA Calculated Score
Neck Score	3
Trunk Score	3
Leg Score	1
Upper Arm Score	6
Lower Arm Score	2
Wrist Score	3
Score A	7
Score B	9
Score C	9
Activity Score	2
Final REBA Score	11

The table above shows a REBA score of 11, indicating that there is a very high level of MSDs risk associated with loading of freights in company XZY Shipping department, hence the need for an urgent investigation, control and application of treatments. The neck and the trunk scores were high (3 and 3) respectively this is because the conveyor is below the mid body line causing the workers to assume a forward neck flexion of about 20 degrees and a forward spine flexion of over 45 degrees from vertical. The workers assume a relatively neutral standing posture, hence a leg score of 1 was assigned., this was because of the neutral position maintained by the employee while on an assigned task. Score A included the sum of the neck, trunk and leg scores. However, with some freights weighing as much as 50 pounds, a force/load score of 2 was added to make the total for score A to be 7. A score of 6 was assigned for the upper arm posture as employees were seen consistently reaching above their shoulders and assume shoulder flexion at approximately 180° repeatedly. Workers examined where seen operating their lower arm above mid-level, with elbow flexion of about 105°, and wrist extension at some points was as high as 45° that was associated with hand pronation. The associated movement of the lower arm and the wrist resulted in score of 2 for both the lower arm position and 3 for the wrist posture. There was no hand-hold or coupling detected, thus, 0 was added to the B score. Using the REBA worksheet, a score of 9 was assign to the B category. The loading process was extremely repetitive and forceful as such an activity score of 2 was added. In order to calculate the final REBA score, the activity score was added to the Table C score (upper [A] and lower [B] extremities scores) on the work sheet to result a score of 11 which indicates that the loading process poses very high risk to employees of the shipping department of company XYZ, hence the need for immediate implementation of control and treatment plans to the current process to avoid the risk of musculoskeletal disorders among workers in the shipping department of company XYZ.

As outlined earlier, The REBA ergonomic task analysis tool and the GAIG ergonomic task analysis worksheet were used for this research.

The second objective of this study was to determine on quantitative basis the extent of awkward posture, contact force, repetition, duration, and temperature extremities with the GAIG ergonomic task analysis worksheet (see Appendix B). The assessment method covers wider areas as it relates to the employee and the work environment. It covers external factors such as noise, temperature, floor surface, lighting condition of the employee work station in addition to the other extremities stated earlier. Scoring of the risk Factors was mainly base on three levels. Depending on the identify risk level, a condition or risk factor can be classified as ideal, warning level and take action.

A summary worksheet of the identified ergonomic-based risk factors associated with loading of freights in company XYZ can be seen in Appendix B. identified factors are quantified base on worst case scenario as seen during the observation process. Based on the researcher's observation, as stated in the completed summary worksheet, which is presented in the later part of Appendix B, the risk factor for repetition is at the take action level. Workers were seen stacking boxes of freight at a rate as high as 30-40 cases per minute. Posture wise, the standing position was scored ideal. Since the task under consideration doesn't require any seating task, the seating posture wasn't scored. A warning level score was assigned to head/neck posture, this is so because even though the task doesn't directly require the worker to bend his/her neck in a forward flexion always, but due to the low height of the conveyor, the worker will have to take a forward flexion posture of the neck/head every time he/she is required to pick up freight from the conveyor belt to stack.

Employees are also seen bending their neck backward and twisting as much as over 20 degrees when trying to stack freights to a height above their shoulder level, as such this posture level is scored in the level of take action. There was no sideway cervical/neck bending detected, thus these postures were scored in the ideal column. Picking up of freights from the conveyor and eventually stacking them requires a very high frequent movement of the hand and wrist. Hand rotation of more than 20° was observed frequently, thus, the hands posture risk factor was scored in the take action column so also is the score for the wrist posture. A wrist backward flexion of more than 60 degrees was seen frequently. The loading process does not involve any form of vibration to any part of the body, as such the vibration risk factor scored ideal. Often than not, workers to frequently reach above their shoulders level and assume shoulder flexion of about 120° or more to stack freight as high as possible, therefore the reach/proper height posture was assigned a scored to take action level. Also, during the lifting and reaching to stack process, the workers were observed to assume elbow flexion of more than 110° which scored such posture in the warning column. Though workers were supposed to move and lead with their feet, but more that often, that is not the case. Workers are seen throughout the observation process to be twisting sideways and bending /reaching forward more than 45° and 60° respectively and as such a score to take action was assigned to both twisting and reaching forward risk factors. The average weight of freight lifted by worker was calculated to be over 25lb and highly repetitive, hence the force risk factor was scored as take action. No pinch grip was observed hence the section was scored with ideal. Also, gloves are worn but optional, as freight are not slippery, therefore the section was scored ideal.

No static risk factor was found since there was no posture or freight that needed to be held for a duration of more than six seconds, the static loading factor was scored as ideal. However, the entire process of loading trailer with freights weighing and average of 25lb and at an average rate of 400 cases/freights per hour, the process is term to be highly repetitive. So, the section is scored to take action. For the work environment, the work pace was scored to take action as the task was highly repetitive because employees are made to worker under very fast pace. The lighting condition and temperature at the time of the study was ideal. However, employees stated that that's not the case during the summer, as the trailers are unsuitable to work in due to excessive heat despite the availability of a ventilation system. Hence a take action score was assigned to temperature and ideal for lighting. The floor and standing platform/surface score was scored warning level for both because it does not provide adequate grip and no ergonomic mat provided to absorb the pressure on the feet that could result from long hours of standing, which may contribute to slight stress on the back and legs. Moreover, since the task requires standing for the complete duration of the task period, this could lead to stress to the back and legs, so the task was scored in the take action column.

Final objective of the study was to review the company' OSHA 300 log to find a trend between our assessment and existing company's personal injury records and determine the frequency of injuries caused by the ergonomic-based risk factors in the shipping department of company XYZ that are related to the loading of freights in trailers.

The review of the 2018 and first quarter of 2019 personal injury log of company XYZ shows that 12 and 5 ergonomic-based injuries respectively occurred in the shipping department of company XYZ. Table 3 below displays the ergonomic injuries that occurred during the past one year and 4 months in the shipping department of company XYZ that are as a result of ergonomic base risk factors.

Table 3

Ergonomic Injuries Related to Loading of Freights in Trailer for Shipping in XYZ

Job Function	Injury Cause	Injury Type	Body Part
Loader	Overexertion	Muscle Soreness	Wrist
Loader/Distributor	Repetitive Action	Muscle soreness	Wrist
Loader	Overexertion	Hernia	Groin
Loader	Overexertion	Strain	Back
Loader	Overexertion/Heavy Object	Pain/Discomfort	Back
Loader	Contact/heavy Object	Sprain/Pain	Knee
Loader	Overexertion/Stacking	Sprain	Back
Loader	Contact	Sprain	Wrist
Loader	Loss of Balance	Strain	Back
Loader	Repetitive Action	Strain	Shoulder
Loader	Contact	Cut	Finger
Loader	Contact	cut	Arm
Loader	Contact	Contusion	Ankle
Loader	Repetitive Motion	Swelling/Inflammatory	Multiple Body Parts
Loader	Overexertion	Strain	Back/Shoulder
Loader	Overexertion	Muscle Strain/Soreness	Multiple Body Parts

The illustration in Table 3 above established that sixteen OSHA recordable injuries occurred in the period under review. Overexertion and repetitive motion are the most common causes of the company' total injury list, which is believed to be because of the highly repetitive motion and over exertive (Forward flexion, reaching above shoulder level, twisting, bending and backward flexion) nature of the task in the shipping department. Of the total 28 injuries recorded in the period under review, more than 50% are contributed by ergonomic risk factor particularly overexertion and repetitive motion of various body parts.

Discussion

The final REBA assessment score of 11 obtained from the REBA assessment tool show the presence of significant MSDs risk factor in the shipping department of company XYZ. The results indicate the presence of several risk factors that require immediate implementation of treatment and control measure to eliminate the risk. The assessment reveals that employees are continually overexerting and reaching forward at angles and heights that could put employees at great risk of MSDs over time. Awkward postures, twisting and repetitive motion all combine to place a significant exposure level of employees of company XYZ in the shipping department to MSDs which could develop over time or in an instance.

The take action score assigned to most of the categories analyzed using the ergonomics task analysis worksheet also buttress the availability of enormous risk factors in the assessed department of company XYZ. The assessment reveal that the working environment such temperature also contribute to exposing the employees to MSDs.

The third purpose of the study was to establish a pattern of injury in the past 16 months of company XYZ and use that to deduce the relationship between the analyzed task and injury level/pattern of company XYZ. The review of the company' personal injury records indicate that most of the company' injury from the shipping department are as a result of overreaching, twisting, repetitive motion, and overexertion. The company' injury log in the period under review indicates that over 90% of the injuries are caused as a result ergonomic risk factors such as repetitive motion, overexertion, lifting of heavy object and awkward posture also identified by this study.

Chapter V: Conclusions and Recommendations

The need to identify and analyze ergonomic based risk factors that employees of the shipping department of company XYZ might be exposed to while performing their job functions is the principal purpose of this study. Another key purpose was to determine previous injury trends in the shipping department of company XYZ and use the findings to compare with MSDs risk factors earlier identified. We set out designated goals to enable us achieve the purpose of the study. The goals include;

- To use the REBA ergonomic assessment tool and GAIG ergonomics assessment worksheet to perform an ergonomic workstation analysis.
- Review past personal injury records of company XYZ to determine previous year's injury trends and pattern.

Findings

Both the REBA and GAIG ergonomic assessment tool portray a disturbing finding. With a REBA score of 11, the process of loading trailers with freight off the loading conveyor can be said to be at a very high risk level. The findings were in agreement with the result of the GAIG ergonomic task analysis worksheet. In almost all the segments analyzed using the GAIG ergonomic worksheet, a take action score was assigned indicating the existence of very high risk level that could be of eminent danger to employees of company XYZ. Both assessments point to the existence of highly repetitive motions, twisting and bending of upper body parts, awkward body postures, arm and wrist flexion, spine flexion, and neck flexion, in addition to excessive work hours in a standing position.

Company XYZ’s OSHA 300 logs indicated that there were 32 injuries recorded in the last year, of this number 18 are from the department of shipping, representing over 50% of the entire company’ injury record in a single year.

Conclusions

Based on the data collected from the results of the REBA, ergonomic task analysis worksheet, and review of the company’ OSHA 300 log we can safely make the following deductions;

The final score of 11 generated from the REBA and the GAIG ergonomic task analysis assessment performed to assess the freight loading process of company XYZ indicates a very high level of risk, and a need for immediate investigation and implementation of treatment measures is required. A dissection of the assessment reveals that virtually every aspect of the task of the loader is exposed to an MSD risk due to the awkward postures they had to assume, such as excessive spine, upper/lower arm and neck flexion in addition to the excessive repetition of task over long periods of time. This assertion was validated by the review of the company’ OSHA 300 log and the personal injury record of company XYZ, which clearly indicates that more than 50% of the total injury list of company XYZ is from the shipping department. Ergonomic risk factors such as those identified and associated with this study, when occur concurrently; pose an imminent risk of developing a musculoskeletal injury/illness in associated muscles, nerves and/or other soft tissues (Chengalur et al., 2004).

Recommendations

Due to the very high risk associated with the activity under study, several recommendations are suggested below to either eliminate or reduce the presence of ergonomic risk factors associated with the manual material handling process among loaders in the shipping department. The recommendation will be divided into two broad categories namely engineering and administrative control.

Engineering Controls

Based on the study, the presence of risk in loading freights can hardly be eliminated without a complete automation of the whole process. This will eliminate manual application of labor. An automation in the form of robot that will easily and efficiently pick up freight from the conveyor and stack them accordingly. Human presence might still be required; however, the job will only be to monitor and adjust the robot. The process of automation if done effectively will save the company millions of dollars by eliminate injuries, using up more space in the trailer, getting the job done in a timely manner and reducing human capital cost considerably.

Administrative Controls

Even though automation seems to be the perfect solution to the ergonomic risk factors identified in this study, the study is not unaware of the tremendous resources in the form material and time to achieve full automation. Therefore, for palliative measures the study recommend that certain administrative controls should be implemented to reduce the level of employee's exposure to the identified risk factors in the shipping department. Some of the recommended administrative controls include:

- Ensure employees are engage in daily warm up exercise before the commencement of their task. This will reduce stiffness in muscle and also reduce chances of muscle fatigue.
- Train employees on proven safe working principles such proper lifting techniques, use of stools to avoid overexerting and reaching, using their feet to move rather than twisting, power lifting, use of two hand to lift objects irrespective of the weight, and

use their leg muscles when bending or lifting freights from the trailer floor rather than bending their back muscles.

- Management should man each trailer with two persons to reduce repetitive movement and cushion the pace.
- Currently employees work 10hrs shifts with double twenty minutes break, this is too long a period for such a difficult and demanding task. So therefore, work days should be reduced to 8hrs and two twenty minutes breaks in between.
- Management should introduce rotation of job. Employees should alternate between light duty task and loading.
- Management should reduce the current pace at which the conveyors run. This will reduce the pressure on the workers as less freight per hour will get to them. This very important considering the very high rate of repetitive motion while carry out a loading task
- Management should also set up a compliance team that will through regular monitoring ensure that employees are engaging in safe work practices and identify previously unidentified risk factors.

Areas of Further Research

Further research is needed to identify optional loading method and automation of the loading process other than the measures recommended in this study.

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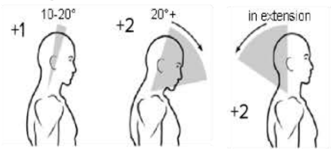
Appendix A: REBA Employee Assessment Worksheet

REBA Employee Assessment Worksheet

Task Name: Freight Loading   Date: April 2019

A. Neck, Trunk and Leg Analysis

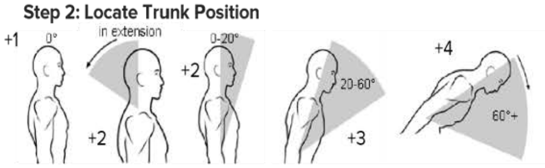
Step 1: Locate Neck Position



3
Neck Score

Step 1a: Adjust...
If neck is twisted: +1
If neck is side bending: +1

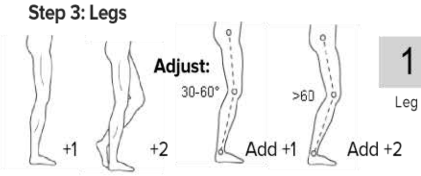
Step 2: Locate Trunk Position



Step 2a: Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

3
Trunk Score

Step 3: Legs



1
Leg Score

Step 4: Look-up Posture Score in Table A
Using values from steps 1-3 above,
Locate score in Table A

5
Posture Score A

+

Step 5: Add Force/Load Score
If load < 11 lbs. : +0
If load 11 to 22 lbs. : +1
If load > 22 lbs.: +2
Adjust: If shock or rapid build up of force: add +1

2
Force / Load Score

=

Step 6: Score A, Find Row in Table C
Add values from steps 4 & 5 to obtain Score A.
Find Row in **Table C**.

7
Score A

Scoring
1 = Negligible Risk
2-3 = Low Risk. Change may be needed.
4-7 = Medium Risk. Further Investigate. Change Soon.
8-10 = High Risk. Investigate and Implement Change
11+ = Very High Risk. Implement Change

Scores

Table A		Neck											
		1				2				3			
	Legs	1	2	3	4	1	2	3	4	1	2	3	4
Trunk Posture Score	1	1	2	3	4	1	2	3	4	3	3	5	6
	2	2	3	4	5	3	4	5	6	4	5	6	7
	3	2	4	5	6	4	5	6	7	5	6	7	8
	4	3	5	6	7	5	6	7	8	6	7	8	9
	5	4	6	7	8	6	7	8	9	7	8	9	9

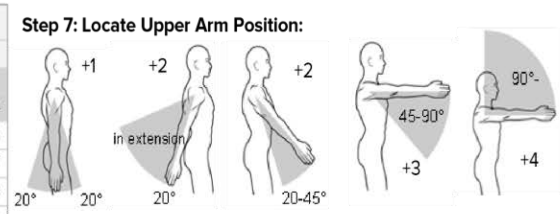
Table B		Lower Arm					
		1			2		
	Wrist	1	2	3	1	2	3
Upper Arm Score	1	1	2	2	1	2	3
	2	1	2	3	2	3	4
	3	3	4	5	4	5	5
	4	4	5	5	5	6	7
	5	6	7	8	7	8	8
	6	7	8	8	8	9	9

Score A	Table C Score B											
	1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	1	2	3	3	4	5	6	7	7	7
2	1	2	2	3	4	4	5	6	6	7	7	8
3	2	3	3	3	4	5	6	7	7	8	8	8
4	3	4	4	4	5	6	7	8	8	9	9	9
5	4	4	4	5	6	7	8	8	9	9	9	9
6	6	6	6	7	8	8	9	9	10	10	10	10
7	7	7	7	8	9	9	9	10	10	11	11	11
8	8	8	8	9	10	10	10	10	10	11	11	11
9	9	9	9	10	10	10	11	11	11	12	12	12
10	10	10	10	11	11	11	11	12	12	12	12	12
11	11	11	11	11	12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12	12	12	12	12	12

10 + 1 = 11
Table C Score   Activity Score   REBA Score

B. Arm and Wrist Analysis

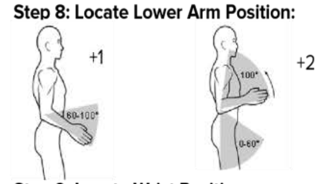
Step 7: Locate Upper Arm Position:



Step 7a: Adjust...
If shoulder is raised: +1
If upper arm is abducted: +1
If arm is supported or person is leaning: -1

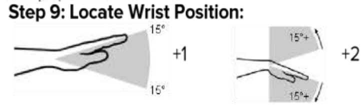
6
Upper Arm Score

Step 8: Locate Lower Arm Position:



2
Lower Arm Score

Step 9: Locate Wrist Position:



3
Wrist Score

Step 9a: Adjust...
If wrist is bent from midline or twisted : Add +1

Step 10: Look-up Posture Score in Table B
Using values from steps 7-9 above, locate score in Table B

9
Posture Score B

+

Step 11: Add Coupling Score
Well fitting Handle and mid rang power grip, ***good: +0***
Acceptable but not ideal hand hold or coupling acceptable with another body part, ***fair: +1***
Hand hold not acceptable but possible, ***poor: +2***
No handles, awkward, unsafe with any body part, ***Unacceptable: +3***

0
Coupling Score

=

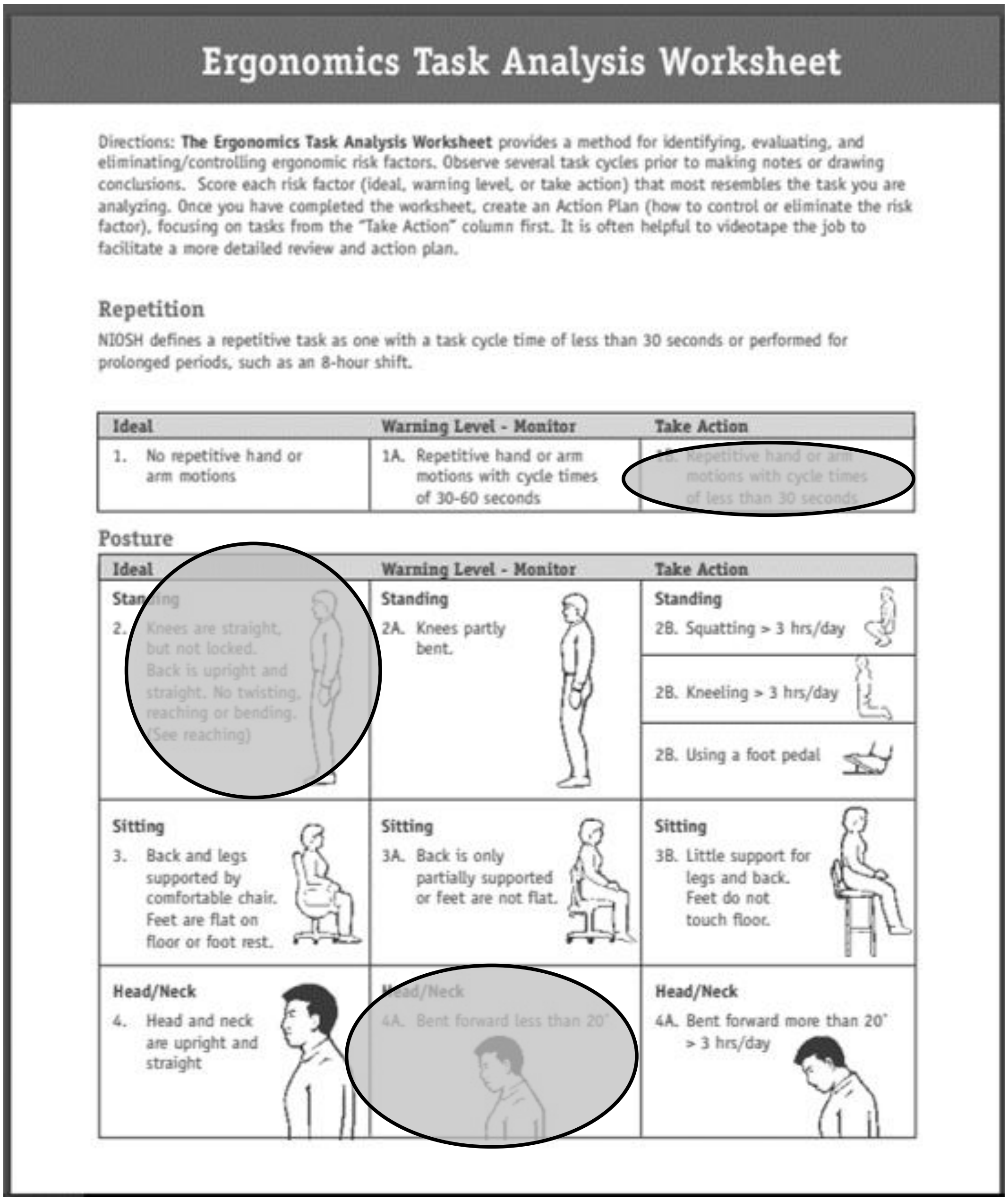
Step 12: Score B, Find Column in Table C
Add values from steps 10 &11 to obtain Score B. Find column in **Table C** and match with Score A in row from step 6 to obtain Table C Score.

9
Score B

Step 13: Activity Score
+1 1 or more body parts are held for longer than 1 minute (static)
+1 Repeated small range actions (more than 4x per minute)
+1 Action causes rapid large range changes in postures or unstable base

Original Worksheet Developed by Dr. Alan Hedge. Based on Technical note: Rapid Entire Body Assessment (REBA), Hignett, McAtamney, Applied Ergonomics 31 (2000) 201-205

Appendix B: GAIG Ergonomiocs Task Analysis Worksheet



Ergonomics Task Analysis Worksheet

Directions: **The Ergonomics Task Analysis Worksheet** provides a method for identifying, evaluating, and eliminating/controlling ergonomic risk factors. Observe several task cycles prior to making notes or drawing conclusions. Score each risk factor (ideal, warning level, or take action) that most resembles the task you are analyzing. Once you have completed the worksheet, create an Action Plan (how to control or eliminate the risk factor), focusing on tasks from the "Take Action" column first. It is often helpful to videotape the job to facilitate a more detailed review and action plan.

Repetition

NIOSH defines a repetitive task as one with a task cycle time of less than 30 seconds or performed for prolonged periods, such as an 8-hour shift.

Ideal	Warning Level - Monitor	Take Action
1. No repetitive hand or arm motions	1A. Repetitive hand or arm motions with cycle times of 30-60 seconds	1B. Repetitive hand or arm motions with cycle times of less than 30 seconds

Posture

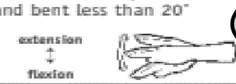
Ideal	Warning Level - Monitor	Take Action
Standing 2. Knees are straight, but not locked. Back is upright and straight. No twisting, reaching or bending. (See reaching)	**Standing** 2A. Knees partly bent.	**Standing** 2B. Squatting > 3 hrs/day 2B. Kneeling > 3 hrs/day 2B. Using a foot pedal
Sitting 3. Back and legs supported by comfortable chair. Feet are flat on floor or foot rest.	**Sitting** 3A. Back is only partially supported or feet are not flat.	**Sitting** 3B. Little support for legs and back. Feet do not touch floor.
Head/Neck 4. Head and neck are upright and straight	**Head/Neck** 4A. Bent forward less than 20°	**Head/Neck** 4A. Bent forward more than 20° > 3 hrs/day

Reach/Proper Height

Ideal	Warning Level - Monitor	Take Action
9. Work should be performed at 90° or slightly above or below elbow level	9A. Arms forward up to 45° or frequently maintained outside of the ideal position > 4 hrs/day	9A. Arms forward more than 45° or constantly maintained outside of the ideal position > 3 hrs/day
	9B. Arms back up to 20° and no more than 2-4 times per minute > 4 hrs/day	9B. Arms back more than 20° or more than 4 times per minute > 3 hrs/day
	9C. Elbows bent up to 25% above or below the ideal position > 4 hrs/day	9C. Elbows bent more than 25% above or below the ideal position > 3 hrs/day
	9D. Elbows up to 45° away from body > 4 hrs/day	9D. Elbows more than 45° away from body > 3 hrs/day
10. No twisting, reaching or bending	10A. Twisting up to 45° or frequent twisting (2-4 times per minute)	10A. Twisting more than 45° or highly repetitive twisting (more than 4 times per minute)
	10B. Bending/reaching forward up to 45°, frequent bending (2-4 times per minute) or > 30% more than 4 hours per day without support	10B. Bending/reaching forward more than 45°, highly repetitive bending (more than 4 times per minute) or more than 2 hours per day without support
	10C. Bending/reaching to the side up to 20° or frequent bending (2-4 times per minute)	10C. Bending/reaching to the side more than 20° or highly repetitive bending to the side (more than 4 times per minute)

Posture (continued)

Ideal	Warning Level - Monitor	Take Action
Head/Neck 4. Head and neck are upright and straight 	**Head/Neck** 4B. Bent back less than 10° 	**Head/Neck** 4B. Bent back more than 10° 
	4C. Bent sideways less than 20° 	4C. Bent sideways more than 20° 
	4D. Twisting neck less than 20° 	4D. Twisting neck more than 20° 

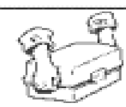
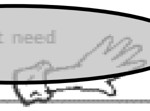
Ideal	Warning Level - Monitor	Take Action
Hands 5. Palms are vertical (handshake position) 	**Hands** 5A. Hands rotate less than 20° 	**Hands** 5A. Hands rotate more than 20° 
Wrists 6. Wrists are straight 	**Wrists** 6A. Wrists are bent between 5 and 30 times per minute and bent less than 20° 	**Wrists** 6A. Wrists are bent more than 30 times per minute or bent more than 20° 
	6B. Wrists move sideways between 5 and 30 times per minute and less than 20° 	6B. Wrists move sideways more than 30 times per minute or more than 20° 

Vibration (Check with tool manufacturer for recommendations or warnings.)

Ideal	Warning Level - Monitor	Take Action
7. No hand or arm vibration	7A. Occasional hand or arm vibration	7B. Constant hand or arm vibration
8. No whole body vibration	8A. Occasional whole body vibration	8B. Constant whole body vibration

Force

Force is the amount of physical effort required to do a task or maintain control of the tools or equipment. Effort depends on the weight of the object, type of grip, object dimensions, type of activity, slipperiness of the object and duration of the task.

Ideal	Warning Level - Monitor	Take Action
11. Objects lifted by hand weigh less than 1 pound	11A. Objects lifted by hand weigh less than 1 pound and frequent lifting (no more than 20 times an hour)	11B. Objects lifted by hand weigh more than 1 pound or highly repetitive lifting (more than 20 times an hour)
12. Objects lifted by the back weigh less than 5 pounds	12A. Objects lifted by the back weigh between 5 and 25 pounds or frequent lifting (no more than 20 times/hour)	12B. Objects lifted by the back weigh more than 25 pounds or highly repetitive lifting (more than 20 times/hour)
Duration 13. No pinch grip used. Fingers and thumb comfortably fit around tool or object 	**Duration** 13A. Moderate pinch grip or pinch grip with less than 2 pounds of force 	**Duration** 13A. Severe pinch grip or pinch grip used with greater than 2 pounds of force 
	13B. Grip is slightly too wide 	13B. Grip is extremely wide 
14. Power grip used with little to no force.	14A. Power grip used with less than 10 pounds of force. Forearm rotation force is less than 5 pounds	14B. Power grip used with more than 10 pounds of force. Forearm rotation force is more than 5 pounds
15. Entire hand controls trigger 	15A. Thumb activated control 	15B. Finger(s) activated control 
16. Tools or objects have handles that are rounded	16A. Awkward handles	16B. Handles, tools or objects that concentrate force or have no handles
	16A. Tools with awkward handles 	16B. Handles that concentrate force 
	Choose One	
	16A. Objects with awkward handles 	16B. Objects with no handles 
Slipperiness 17. Gloves do not need to be worn at any time 	**Slipperiness** 17A. Gloves are needed but fit well 	**Slipperiness** 17B. Gloves are needed but fit poorly 

Static Loading and Fatigue

Static loading refers to staying in the same position for prolonged periods. Tasks that use the same muscles or motions for long durations (6 seconds or more at one time) and repetitively (more than 50% repetition) increase the likelihood of fatigue.

Ideal	Warning Level - Monitor	Take Action
Duration 18. Constant position, tool or object is held less than 6 seconds	**Duration** 18A. Constant position, tool or object is held 6 to 10 seconds	**Duration** 18B. Constant position, tool or object is held more than 10 seconds
Repetition 19. Less than 25% of the task is repetitive	**Repetition** 19A. 25% to 50% of the task is repetitive	**Repetition** 19B. More than 50% of the task is repetitive

Pressure/Contact Stress/Repeated Impacts

Refers to pressure or contact from tools or equipment handles with narrow width that create local pressure. It also applies to sharp corners of desks or counter tops. Impact refers to the use of hands, knees, foot, etc. as a hammer. *(Related to Force Conditions in item 16.)*

Ideal	Warning Level - Monitor	Take Action
20. No contact or impact stress: tools, objects, or workstation do not press against hands or body	20A. Occasional and minimal pressure or impact on hands or body. Hand, knee or other body part used as hammer less than 2 hours/day	20B. Constant pressure or impact on hands or body. Hand, knee or other body part used as hammer more than 2 hours/day

Lifting and Materials Handling

Ideal	Warning Level - Monitor	Take Action
21. No lifting or lowering of materials (see also Force for weights of objects handled)	21A. Occasional lifting and/or lowering (no more than 20 times per hour)	21B. Constant lifting and/or lowering (more than 20 times per hour)
Push/Pull 22. No pushing or pulling of carts or materials	**Push/Pull** 22A. Pushing or pulling 10-50 carts per shift	**Push/Pull** 22B. Pushing or pulling more than 50 carts per shift
23. Slight force is required to push or pull carts or materials. Pushing is preferred over pulling objects.	23A. Moderate force is required to push or pull carts or materials.	23B. High force is required to push or pull materials.

Work Pace 24. Worker has adequate control over work pace.	**Work Pace** 24A. Worker has some control over work pace.	**Work Pace** 24B. Worker has no control over work pace.
Lighting 25. The lighting is adequate for the task.	**Lighting** 25A. The lighting is slightly too bright or too dark for the task.	**Lighting** 25B. The lighting is significantly too bright or too dark for the task.
Temperature 26. The temperature is comfortable.	**Temperature** 26A. The temperature is slightly too cold or too hot.	**Temperature** 26B. The temperature is significantly too cold or too hot.
Noise 27. The work area is quiet.	**Noise** 27A. The work area is slightly noisy.	**Noise** 27B. The work area is significantly noisy (too noisy to carry on a conversation).
Floor Surface 28. The flooring provides good traction. 29. The flooring is sufficiently padded to relieve stress on back and legs. 30. Floor mats are provided to relieve stress on back and legs. Employee can alternate between sitting and standing.	**Floor Surface** 28A. The flooring is slightly slippery. 29A. The flooring contributes slight stress to the back and legs. 30A. Standing 0-50% of time without floor mats or other means to relieve stress on back and legs.	**Floor Surface** 28B. The flooring is moderately to extremely slippery. 29B. The flooring contributes moderate to extreme stress to the back and legs. 30B. Standing more than 50% of time without floor mats or other means to relieve stress on back and legs.

Comments: ______________________________

Note: The levels provided above are standard practices which have been accepted or established by NIOSH, OSHA, ANSII and other related organizations.

The loss prevention information provided in this brochure is based on generally accepted safe practices for minimizing loss in the described situations. In providing such information, Great American Insurance Group does not warrant that all potential hazards or conditions have been evaluated or that they can be controlled. The information is not intended as an offer to write insurance for such conditions or exposures. The liability of Great American and/or its subsidiaries is limited to the terms, limits and conditions of actual insurance policies issued to specific insureds.

Summary Worksheet

Date ________________

Condition	Ideal	Warning Level	Take Action
Repetition			
1. No repetitive hand or arm motions. (*Monitor* if repetitive cycle every 30-60 seconds; *take action* if repetitive cycle of less than 30 seconds.)	1	1A	1B
Posture			
2. Standing, with knees straight but not locked. (*Monitor* if standing with knees partially bent; *take action* if using a foot pedal or squatting or kneeling more than 3 hours/day.)	2	2A	2B
3. Sitting, back and legs comfortably supported, feet flat on floor/floor rest. (*Monitor* if back partially supported or feet not flat on floor; *take action* if little support for back and legs, feet not touching floor.)	3	3A	3B
4. Head and neck are upright and straight. (*Monitor* if head and neck are bent forward < 20˚; *take action* if >20˚ >3 hours/day.)	4	4A	4A
Head and neck are bent back. (*Monitor* if < 10˚; *take action* if >10˚.)	4	4B	4B
Head and neck are bent sideways. (*Monitor* if < 20˚; *take action* if >20˚.)	4	4C	4C
Head and neck are twisting. (*Monitor* if < 20˚; *take action* if >20˚.)	4	4D	4D
5. Hands (palms) are vertical. (*Monitor* if hands rotate < 20˚; *take action* if hands rotate >20˚.)	5	5A	5B
6. Wrists are straight. (*Monitor* if wrists are bent, extension/flexion, < 20˚ for 5-30 times/minute; *take action* if bent >20˚ or >30 times/minute.)	6	6A	6A
Wrists move sideways, ulnar/radial. (*Monitor* if < 20˚ and 5-30 times/minute; *take action* if bent >20˚ or >30 times/minute.)	6	6B	6B
Vibration			
7. No hand or arm vibration. (*Monitor* if occasional; *take action* if constant.)	7	7A	7B
8. No whole body vibration. (*Monitor* if occasional; *take action* if constant.)	8	8A	8B
Reach			
9. Arms positioned at elbow level. (*Monitor* if up to 45˚ or frequently out of ideal position for more than 4 hours/day; *take action* if arms are forward >45˚ or constantly out of ideal position >3 hours/day.)	9	9A	9A
Arms back. (*Monitor* if arms back up to 20˚ between 2-4 times/minute for more than 4 hours/day; *take action* if arms back >20˚ or >4 times/minute for more than 3 hours/day.)	9	9B	9B
Elbows bent upward. (*Monitor* if elbows bent up to 25% above or below ideal position >4 hours/day; *take action* if bent upward >25% above or below ideal position >3 hours/day.)	9	9C	9C
Elbows away from body. (*Monitor* if elbows are up to 45˚ away from body >4 hours/day; *take action* if elbows are >45˚ away from body >3 hours/day.)	9	9D	9D
10. No twisting, reaching or bending, twisting/repetitive. (*Monitor* if twisting up to 45˚ or 2-4 times/minute; *take action* if >45˚ or >4 times/minute.)	10	10A	10A
Reaching/bending forward. (*Monitor* if bending/reaching forward up to 45˚ or 2-4 times/minute or >30˚ for >4 hrs/day w/out support; *take action* if >45˚ or >4 times/minute or >2 hrs/day w/out support.)	10	10B	10B
Reaching/bending to the side. (*Monitor* if up to 20˚ or 2-4 times/minute; *take action* if >20˚ or >4 times/minute.)	10	10C	10C
Force			
11. Objects lifted by hand weigh less than one pound. (*Monitor* if objects weighing < 1 lb. are lifted up to 20 times/hour; *take action* if objects weigh >1 lb. or lifting occurs >20 times/hour.)	11	11A	11B
12. Objects lifted by the back weigh less than 5 pounds. (*Monitor* if objects weigh 5-25 lbs. or lifting occurs up to 20 times/hour; *take action* if objects weigh >25 lbs. or lifting occurs >20 times/hour.)	12	12A	12B
13. No pinch grip used. (*Monitor* use of pinch grip with < 2 lbs. of force; *take action* if pinch grip with >2 lbs. of force is used.)	13	13A	13A
Wide pinch grip used. (*Monitor* if slightly too wide; *take action* if extremely wide.)	13	13B	13B
14. Power grip used with no force. (*Monitor* if power grip with < 10 lbs. force is used and forearm rotation force is < 5lbs.; *take action* if power grip with >10 lbs. force is used and forearm rotation force is >5 lbs.)	14	14A	14B
15. Entire hand controls trigger. (*Monitor* if thumb controls; *take action* if finger(s) control.)	15	15A	15B
16. Tools or objects have rounded, padded handles. (*Monitor* if handles are awkward; *take action* if there are no handles or handles concentrate force.)	16	16A	16B
17. Gloves do not need to be worn at any time. (*Monitor* if gloves are needed but fit well; *take action* if gloves fit poorly.)	17	17A	17B
Static Loading and Fatigue			
18. Constant position, tool or object is held less than 6 seconds. (*Monitor* if held between 6-10 seconds; *take action* if held >10 seconds.)	18	18A	18B
19. Less than 25% of the task is repetitive. (*Monitor* if 25-50% repetitive; *take action* if >50% repetitive.)	19	19A	19B
Pressure/Contact Stress/Repeated Impacts			
20. No contact/impact stress (*Monitor* if occasional pressure or body part is used as hammer < 2 hours/day; *take action* if constant pressure or body part is used as hammer >2 hours/day.)	20	20A	20B

Summary Worksheet

Date ____________

Condition	Ideal	Warning Level	Take Action
Lifting and Materials Handling			
21. No lifting or lowering of materials. (*Monitor* if occasional and/or no more than 20 times/hour; *take action* if constant and/or greater than 20 times/hour.	21	21A	21B
22. No pushing or pulling of materials. (*Monitor* if pushing/pulling 10-50 carts/shift; *take action* if pushing/pulling more than 50 carts/shift.)	22	22A	22B
23. Slight force is required to push or pull materials. (*Monitor* if moderate force is required; *take action* if high force is required.)	23	23A	23B
Environment			
24. Worker has adequate control over workplace. (*Monitor* if worker has some control; *take action* if worker has no control.)	24	24A	24B
25. Lighting is adequate for the task. (*Monitor* if slightly too dark or bright; *take action* if significantly too dark or bright.)	25	25A	25B
26. Temperature is comfortable. (*Monitor* if slightly too cold or hot; *take action* if significantly too cold or hot.)	26	26A	26B
27. Work area is quiet. (*Monitor* if slightly too noisy; *take action* if significantly too noisy.)	27	27A	27B
28. Flooring provides good traction. (*Monitor* if flooring is slightly slippery; *take action* if moderately to extremely slippery.)	28	28A	28B
29. Flooring is sufficiently padded to relieve stress on back and legs. (*Monitor* if slight stress to back and legs; *take action* if moderately to extreme stress.)	29	29A	29B
30. Floor mats are provided. Employee can alternate between sitting and standing. (*Monitor* if employee is standing up to 50% of shift without floor mats or other stress relief for back and legs; *take action* if standing >50% of shift without floor mats or other relief for back and legs.	30	30A	30B

Action Plan

Today's date: ____________ Date Solution to be Completed ____________

Location/Department: ____________

Job/Task Title: ____________

Evaluator: ____________

Describe MSD in previous 24 months: ____________

____

Task: ____________

Summary of Problem: ____________

____

Alternative Solution and Costs: ____________

____

Recommended Solution: 1) Engineering ____________

____

2) Administrative: ____________

____

3) Use of personal protective equipment ____________

____

Date Solution Actually Completed: ____________ Actual Cost: ____________

Appendix C: IRBs Consent Approval Letter

April 23, 2019

Amos Peter
Operations and Management
University of Wisconsin-Stout

RE: **Ergonomic Analysis of Manual Material Handling of Freights in a Trailer for Shipping**

Dear Amos,

The IRB has determined your project, *"Ergonomic Analysis of Manual Material Handling of Freights in a Trailer for Shipping"* is **Exempt** from review by the Institutional Review Board for the Protection of Human Subjects. The project is exempt under **Category #2** of the Federal Exempt Guidelines. Your project is exempt for 5 years from **April 23, 2019**. If a renewal is needed, it is to be submitted at least 10 working days prior to the approvals end date. Should you need to make modifications to your protocol, please complete the modification form.

Informed Consent: All UW-Stout faculty, staff, and students conducting human subjects' research under an approved "exempt" category are still ethically bound to follow the basic ethical principles of the Belmont Report: 1) respect for persons; 2) beneficence; and 3) justice. These three principles are best reflected in the practice of obtaining informed consent from participants.

If you are doing any research in which you are paying human subjects to participate, a specific payment procedure must be followed. Instructions and form for the payment procedure can be found at http://www.uwstout.edu/rs/paymentofhumanresearchsubjects.cfm

If you have questions, please contact the IRB office at 715-232-2691, or buchanane@uwstout.edu, and your question will be directed to the appropriate person. I wish you well in completing your study.

Sincerely,

[redacted]

Elizabeth Buchanan
Interim Director, Office of Research and Sponsored Programs; Human Subjects Protections Administrator,
UW-Stout Institutional Review Board for the Protection of Human Subjects in Research

CC: Dzissah