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**Hendricks, Anthony A.** ***Evaluation of Ergonomic Stress Factors at Company XYZ***


## Abstract

According to the Bureau of Labor Statistics, musculoskeletal disorders are recognized as a serious workplace health hazard. Employees are susceptible to musculoskeletal disorders if the work they're performing is constantly aggravating ergonomic stress factors. Ergonomic stress factors include; excessive force, excessive repetition, awkward postures, and extreme temperatures. Ergonomic stress factors can be controlled by limiting the employee exposure or by prevention through design. Company XYZ has documented numerous ergonomic stress factors complaints from assembly line electricians that are tasked with assembling electrical wire harnesses. Currently they don't have any metrics in place to quantify employee's symptoms to narrow down the cause of the employee's complaints. Utilizing an ergonomic task analysis worksheet will help evaluate the employee job task to figure out what motions are causing the pain and assist to make recommendations that abate employee exposure to ergonomic stress factors.

## Acknowledgments

I would like to thank Company XYZ for allowing me to perform this study at their facility. I would also like to thank my research advisor, Dr. John Dzissah for his guidance and influence throughout my research. I would also like to thank the rest of my professors and mentors during my time at University of Wisconsin-Stout. Lastly, I would like to thank my family for their unconditional love and support every step of the way.

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## Chapter I: Introduction

Musculoskeletal disorders are injuries or pain within a human musculoskeletal system and can include the joints, ligaments, muscles, nerves, tendons, and structures that support limbs, neck, and back. Some common musculoskeletal disorders are carpal tunnel syndrome, back disability, and rotator cuff tendonitis. Disorders of such may progress over weeks, months, or years. The rate at which the disorder progresses depends on the employee and the exposure rate of the stress factor. The stress factors include; excessive force, excessive repetition, awkward postures, and extreme temperatures (Occupational Health and Safety Association [OSHA], 2000). A mitigating method to reducing employee exposure to those stress factors is implementing an ergonomic plan.

An unbalanced rate of physical work demands pushing individual physical capabilities, which contribute to a higher risk for musculoskeletal disorders (Holterman et al., 2010). Many OSHA injury logs have documented musculoskeletal injuries, including carpal tunnel syndrome, tendinitis, back pain, etc. Musculoskeletal disorders are recognized as a serious workplace health hazard by the Bureau of Labor Statistics (OSHA, 2000).

Ergonomics is an applied science and focuses on the design of equipment to fit the majority of people who must interact with it (OSHA, 2000). The six core elements for a successful ergonomics program are management commitment, employee involvement, identification of problem jobs, analyzing and developing controls for problem jobs, training and education, and medical management (Monroe, 2006). The most critical, being management commitment. This is mainly because management provides the funding for the program and sets the tone for the rest of the staff (Smith, 2003). Having an effective ergonomic plan in place reduces the musculoskeletal disorders and provides a safer work environment overall (Roth, 2011). If any company has indications of employees having musculoskeletal disorders, then an ergonomic plan is recommended (LaBar, 1991).

Company XYZ is a steel manufacturing company that produces and distributes street sweepers. The facility hosts a wide range of office and plant employees. Plant employees are tasked with the production of the street sweepers. The production process is divided step-by-step from start to finish of the street sweeper. The steps include the following: mailing and receiving, welding, painting, then assembly line of putting the parts together, and lastly, testing the finished product. Each step is an intricate piece to delivering quality products not only performing as expected, but also visually appealing to ensure continuous sales.

Mailing and receiving handles receiving parts. They either store them for later use or deliver them to welders. Mailing and receiving also assist with mailing off finished products to the customers. Welders have pre-set layouts based on customers request. Once they receive the steel, they weld it, and then the steel is stored to cool down. After the cool down stage, the steel is delivered to paint where it is paint blasted then touched up by painters per customers request. The finished painted steel is then put through a curing oven and hung up to dry afterwards. After the paint is dry, the pieces of steel are delivered to the assembly line to begin the process of building the street sweeper. The assembly line includes the steel being put together, adding on the engine, adding windows/doors, putting in the radio, adding different features per customers request, and testing to ensure everything works properly.

Company XYZ has documented employee complaints about multiple ergonomic stress factors, including awkward postures, repetitive motion, and excessive reaching during the assembly line stage where electricians are required to assemble an electrical wire harness for the street sweepers on the floor. They can be seated or standing. Either way, the electricians are forced to bend over and reach down in an awkward position for extended periods of time. This leaves them exposed to multiple ergonomic stress factors that could become nagging musculoskeletal injuries.

**Statement of the Problem**

Company XYZ has documented numerous ergonomic stress factors complaints from assembly line electricians. Currently they do not have any metrics in place to measure an employee's symptoms to narrow down the cause of the employee's complaints.

**Purpose of the Study**

Evaluating job tasks of the assembly line electrician must focus on the work assignment, the line balance, and the design of each individual work station (Longo & Mirabelli, 2009) to determine mitigation methods for the ergonomic stress factors associated with assembling an electrical wire harness.

**Definition of Terms**

The following terms are industry-specific and are defined here for clarity.

**Abate.** Reducing a hazard to make it less threatening.

**Direct cost.** Direct cost is the cost of medical bills the employer must cover in case of an injury, usually under insurance.

**Health hazard.** A health hazard is based on considerable evidence, including at least one study conducted in accordance with an established scientific principle that acute or chronic health effects may occur in exposed employees.

**Implement.** Implement means to put a policy or procedure into effect.

**Indirect cost.** Indirect cost is a cost the employer must cover after an injury that is not covered by insured.

**Mitigate.** Mitigate means to make a health hazard less severe, serious, or painful.

## Limitations of the Study

This study has the following limitations:

1. Only first-shift employees are being observed at Company XYZ.
2. It is difficult to quantify activities performed outside of work by the employees.

# Chapter II: Literature Review

The electricians at Company XYZ are potentially at risk for experiencing ergonomic discomfort due to the high exposure of awkward work positions associated with assembling an electrical wire harness. Working in an awkward position for prolonged periods of time increases ergonomics on the body and can lead to musculoskeletal disorders and/or injuries. Company XYZ has documented complaints from employees and does not have a metric system in place in to measure the root cause of the complaints.

The employees at Company XYZ have repeatedly reported discomfort in their back, shoulders, and knees. Over prolonged periods of time without being treated, ergonomic discomfort can lead to musculoskeletal injuries. Musculoskeletal injuries can lead to permanent chronic conditions. Whether the musculoskeletal disorder is acute or chronic, the medical cost can weigh heavily on the employer if deemed work-related. The employer would be liable to cover the employee's medical cost through workers compensation and loss production time from the employee being placed on medical leave or restrictions (OSHA, 2015).

The review of literature for this study discusses different ergonomic strategies that Company XYZ could utilize to assess and mitigate ergonomic hazards.

## Purpose of Ergonomics

An ergonomic program aids with mitigating musculoskeletal disorders in the workplace. When developing an ergonomic plan, management should follow a hierarchy of controls. The hierarchy of controls consists of steps to mitigate workplace hazards. The company should aim to eliminate the hazard if possible, substitute the hazards, provide engineering controls around equipment design, re-assess administrative controls, or provide employees with personal protective equipment (OSHA, 2016).

The first step in the hierarchy of controls consists of the employer eliminating the hazard. Typically, employers use this step if the process is extremely dangerous. It would be safer for the employer to abate this type of hazard than to run the risk of an employee getting injured (OSHA, 2016). If the employer could not eliminate the hazard, then they would proceed to the next step, substitute the hazard.

Substituting a hazard only reduces the hazard to become less harmful to an employee. If substitution is not applicable, then the employer would consider re-evaluating the engineering controls associated with the process. Engineering controls focus on altering the equipment to better fit an employee; however, the hazard could still exist. Administrative controls focus on management strategies to mitigate employee exposure to the hazard. The least effective step in the hierarchy of controls is personal protective equipment, because at this step management accepts the hazard and can only provide equipment to limit the exposure to it (OSHA, 2016). Utilizing the hierarchy of controls puts prevention through design (PtD) and is commonly utilized when establishing an ergonomic program. Schulte (2008) defined PtD as:

> The practice of anticipating and designing out potential occupational safety and health hazards and risks associated with new processes, structures, equipment, or tools, and organizing work, such that it takes into consideration the construction, maintenance, decommissioning, and disposal/recycling of waste material, and recognizing the business and social benefits of doing so. (p.5)

**Prevention through design.** There were 387,820 musculoskeletal disorder injuries reported in 2011, which contributed to 33% of employee injuries that year (Bureau of Labor Statistics [BLS], 2013). Musculoskeletal disorder injuries could have been prevented if an organization had an effective PtD ergonomic program in place. Musculoskeletal disorders generally do not occur overnight, but usually develop over prolonged periods of time due to repetitive motions, over-exertion, and/or extreme temperatures otherwise known as ergonomic stress factors (Weidman et al., 2000). place. Musculoskeletal disorders generally do not occur overnight, but usually develop over prolonged periods of time due to repetitive motions, over-exertion, and/or extreme temperatures otherwise known as ergonomic stress factors (Weidman et al, 2000).

Designing new equipment to eliminate ergonomic stress factors could lead to the reduction of musculoskeletal disorder injuries. Utilizing a PtD approach requires the equipment manufacturers to have a pro-safety mentality when designing the equipment (Weidman et al, 2000). It is important for equipment designers and safety professionals to build a respectful working relationship. Doing so, allows the two to understand each other's objectives and provides a safe working environment for employees (Hoff, 2014).

It is important to get employee feedback during the design phase, because they are the people operating the tools. If the employees are not included, then the management or equipment designers could potentially miss ergonomic hazards recommendations (Aon, 2016). Numerous research studies have been done which proves that employees feedback aided in identifying work related ergonomic hazards.

Gabrille Griffin, an ergonomist in the 1990s, followed several office ergonomic cases. One particular case that Griffin wrote about revolved around a desk employee who felt discomfort in her lower back and arms after every shift for several weeks. Before the employee notified the management team, she evaluated her daily routine to identify any potential task that could have contributed to the discomfort. Since the employee could not figure out the cause of her discomfort, she contacted her management team with her concerns. Management took the time to evaluate the employee's workstation. The team changed the equipment that was contributed to the employee's awkward posture. The adjustments stopped the discomfort from accumulating into a musculoskeletal disorder. Thus, the ergonomic assessment ultimately saved the company from cost associated with musculoskeletal disorders and saved the employee from a prolonged injury (Griffin, 1992).

Including employees, feedback also improves the moral in the workplace and makes employees feel wanted, which in the end leads to better performance (Hoff, 2014). "Management commitment to a well-conceived program for ergonomics may contribute to the safety, health, and overall satisfaction of employees, resulting in higher productivity throughout an organization" (Hoff, 2014, p. 2). The benefits of an effective ergonomics program were determined after Doctor Lowe, an industrial engineer at the National Institute for Occupational Safety and Health, performed research on preventing musculoskeletal disorders for fifth-teen years (Hoff, 2014).

Implementing an efficient ergonomic plan takes work from everyone in the company, including hourly employees to top management. Everyone plays a pivotal role in assisting with a plan to be efficient (Aon, 2016). With emphasis on the PtD concept, it is rewarding when everyone is involved. From the employee's prospective, you notice management is actually listening when you see improvement being done in areas that you may have been worried about. In my experience, seeing that motivated me to continue to work harder for my employer. From management prospective, you are making needed improvements and saving a lot of money from the cost of injuries. As a safety person, you see everyone is involved and contributing to bettering the safety culture. After funding, I believe getting everyone involved is the biggest challenge for having an effective ergonomic plan.

**Successful outcome.** Bath Iron Works is a company that builds United States Navy ships. With such a demanding task, the company takes pride in the quality of work they produce. Bath Iron Works were often working against the clock when trying to complete a ship, leading them to a rapidly increasing musculoskeletal injuries and illnesses. Often, employees who are facing time incentives are pressured to work harder, causing them to aggravate an ergonomic stress factor that leads to a musculoskeletal disorder (McGlothlin, Zavits, & Sullivan, 2014).

No one ever believes there is a problem until something catastrophic occurs, and for Bath Iron Work that was getting cited in 2007 by OSHA under the General Duty Clause 5(a)(1) for not abating recognized hazards (McGlothlin et al., 2014). The General Duty Clause 5(a)(1) states that, “Employers are required to provide their employees with a place of employment that is free from recognized hazard that are causing or likely to cause death or serious harm” (OSHA, 2004, p.1). To avoid the continuous fines and increasing musculoskeletal injuries, Bath Iron Works implemented an ergonomic program that focused on worksite analysis, hazard prevention and control, medical management, and training and educating employees (McGlothlin et al., 2014).

A safety professional performs a worksite analysis. Their job is to analyze the worksite to find hazards that may be present. Hazard prevention and control involves applying the data from the worksite analysis to guide you through research for control of the hazards found. Medical management hires an on-site physician to oversee the injuries an in attempt to mitigate minor injuries before they force an employee to miss time from work. Training is done to ensure the employees know how to perform a task correctly without putting themselves or others in harm’s way, which correlates with educating employees about the hazards and safe practices. Compiling the information from the listed strategies assists when the design of new equipment comes into play. The design professional factors and all concerns from employees to management in an attempt to re-design a tool or equipment that is considered to be hazardous (Hoff, 2014).

Bath Iron Works covered the significant factors in order for an ergonomic program to be effective with continued success. Those significant factors included management commitment, employee involvement, identifying hazards, training, controlling hazards, and monitoring progression (Reich, 1993). Utilizing the PtD ergonomic concept, Bath Iron Works won three awards over the past 6 years dating back 2012 at the Applied Ergonomics Conference. Ultimately, Bath Iron Works lowered their incident rate by 20% and lowered their severity rate 50% over a 5-year interval (McGlothlin et al., 2014), which indicates an effective ergonomics program.

In 2015, Aon conducted a casualty risk control practice survey to provide insight on various industries' risk control measures for their ergonomics program from a pre- and post-lost standpoint. The survey was administered online from March 30, 2015 until June 22, 2015 and consisted of 13 questions. The survey focused on who was responsible for the ergonomic program, the driving ergonomics efforts, and what metrics were being used, and if the measurements were being utilized effectively (Aon, 2016).

The top industries represented in the survey were durable goods manufacturing, which is defined as, "Includes manufacturing of metal, plastic, wood, and electronic products, including assembly, automotive, furniture, and building material from shipped raw materials (e.g., not mined or forested), and including large scale printing operations" (Aon, 2016, p. 8).

Out of the companies that completed the survey 28.32% indicated that their ergonomics program is driven by regional/corporate/global staff (Aon, 2016). Having management actively drive ergonomics increases the chances of an effective ergonomic program (Hoff, 2014). Twenty-seven percent of companies that completed the survey confirmed that they do not have a designated owner for their ergonomics program (Aon, 2016). "Organizations lacking an ergonomics process owner may experience significant lag in process improvements and difficulty sustaining ergonomics initiatives" (Aon, 2016, p. 11).

Employee health and safety continues to be the leading driving force behind ergonomics efforts, and 69.91% of the survey participants agreed as well. The rest of the field selected company culture, regulatory compliance, or management initiative as drivers behind their company's ergonomic related efforts, which shows their carelessness for the ergonomic program (Aon, 2016).

Musculoskeletal injuries do not happen overnight. They are usually a combination of ergonomic stress factors over time. Ergonomics stress factors can be excessive force, awkward postures, and repetitive motions. The two major areas of concern for the companies surveyed were back injuries and hand/wrist injuries, which both had over 68% from the participants. A prevention through design approach can be used to abate the injuries but is expensive. A less expensive approach would be a risk control consultant to perform an ergonomic task analysis to determine the stress factors that contribute to the discomfort that the employee feels (Aon, 2016).

Companies track incidents using the total recordable incident rate and days away restricted rate per federal regulations (OSHA, 2017). The companies that participated in the Aon surveyed reported that 60% of their total recordable injury rate (TRIR) were related to ergonomic musculoskeletal injuries. Forty-six percent of the 60% were placed on restricted duty or could not come into work (Aon, 2016).

Metrics can tend to identify a reactive approach when dealing with workplace injuries. Reactive means the loss occurred in order to obtain the data. OSHA recommends that companies use a pro-active approach. A proactive approach is obtaining quantifiable data on employee's symptoms from a pre-loss standpoint in hopes to mitigate the problem before a loss occurs (OSHA, 2015).

One tool that companies can use to be more proactive is the Ergonomic Task Analysis Worksheet, which is used to quantify employee's ergonomic stress factors. The ergonomic task analysis worksheet breaks down an employee's job tasks to identify the substandard ergonomic stressors. Thirty-five percent of the surveyed participants in the Aon study indicated that they use the ergonomic task analysis tool to evaluate the process design, claim and injury management, and job specific training. Sixty-five percent of the participants expressed that they never utilized the ergonomic task analysis tool (Aon, 2016).

**Ergonomic task analysis.** In 2001, the Great American Insurance Company developed the Ergonomic Task Analysis Worksheet that a company could use to survey employee postures to mitigate potential ergonomic hazards (Great American Insurance Company, 2019). The worksheet assisted with identifying and measuring risk factors associated with the assembly line workers working first shift at Company XYZ (see Appendix A).

The Ergonomic Task Analysis Worksheet categorizes the most common risk factors to observe when evaluating high-risk jobs that can lead to musculoskeletal disorders (Great American Insurance Company, 2004). The risk factor categories include repetition, posture, vibration, reach, force, static loading and fatigue, contact stress impacts, lifting and materials handling, and the environment. Within the categories, the ergonomist must score each risk factor as ideal, warning level, and take-action. Ideal indicates that the task is acceptable, and no changes are required.  Warning level categorizes the action/task as partially acceptable but with some areas of concern that can lead to potential MSD's down the line.  Take-action items are considered high risk actions/tasks that an employee is performing that raises serious concerns to their health.  Such tasks should be abated.

**Summary**

An ergonomic program aids with mitigating musculoskeletal disorders in the workplace. If a company does not proactively address ergonomic concerns, then it could lead to loss production time and cost associated with the recovery time for the employee (Griffin, 1992). One tool that has been utilized by manufacturing and insurance industry to assess ergonomic disorders is the Ergonomic Task Analysis Worksheet.  This worksheet is categorized by ergonomic stressors involving repetition, force, lifting and material handling, static loading, posture, reach, contact stress, and environment.  The worksheet assists with evaluating job tasks. The evaluation breaks down movements to identify ergonomic risk steps in a procedure.

The Ergonomic Task Analysis Worksheet is effective because it details which ergonomic stressor is being aggravated during each step of the task.  This researcher utilized the Ergonomic Task Analysis Worksheet to identify ergonomic stressors associated with Company XYZ electricians assembling an electrical wire harness.

## Chapter III: Methodology

Company XYZ has documented numerous amounts of employee complaints about ergonomic stress factors. The company does not have a metric system in place to measure the root cause of the complaints, leaving them susceptible to reoccurring musculoskeletal injuries. Using an Ergonomic Task Analysis Worksheet will help evaluate the employee job task to figure out what physical motions are causing pain and assist in making recommendations to abate the problem. The goals that guided this study were:

- Use the Ergonomic Task Analysis Worksheet to evaluate the process of assembling an electrical wire harness.
- Analyze the data collected to identify which ergonomic stressors are contributing factors to employee musculoskeletal disorder complaints.

### Instrumentation

The Ergonomic Task Analysis Worksheet, created by the Great American Insurance Company (2004), assists with identifying and measuring risk factors associated with the assembly line workers working the first shift at Company XYZ. A sample of the worksheet is located in Appendix A. The Ergonomic Task Analysis Worksheet categorizes the most common risk factors to observe when evaluating high-risk jobs that can lead to musculoskeletal disorders (Great American Insurance Company, 2004). The risk factor categories include repetition, posture, vibration, reach, force, static loading and fatigue, contact stress impacts, lifting and materials handling, and the environment. Within the categories, the ergonomist must score each risk factor as ideal, warning level, and take-action. Ideal is considered acceptable with no changes required. Warning level categorizes the action/task as acceptable but with some areas of concern that can lead to injuries. Take-action items are high risk tasks an employee performs constantly that raise concern to their health and should be abated.

### Data Collection Procedures

The assembly line electrician was evaluated using the Ergonomic Task Analysis Worksheet during the first shift while assembling an electrical wire harness. The worksheet assisted with grading the following ergonomic stress factors: repetition, posture, vibration, reach, force, static loading, pressure, lifting and materials handling, and the environment.

### Data Analysis

When categories are graded ideal, then the job task will not have any risk factors associated with musculoskeletal disorders. When categories are graded as warning level, the job task may present risk factors associated with musculoskeletal disorders and recommendations would be made to abate the risk. When categories are graded take-action, the job task is contributing to musculoskeletal disorders and should be abated immediately.

### Limitations

This study had the following limitations:

1. Only the first shift employee was evaluated at Company XYZ.
2. It is difficult to quantify activities performed outside of work by employees that could contribute to musculoskeletal disorders.

# Chapter IV: Results

Company XYZ has documented numerous amounts of employee complaints about ergonomic stress factors and does not have a metric system in to measure the root cause of the complaints. This leaves employees susceptible to reoccurring musculoskeletal injuries. Using an ergonomic task analysis worksheet helped in evaluating the job task to figure out what motions are causing the pain and assist to make recommendations to abate the problem. The goals that guided this study were:

- Use the Ergonomic Task Analysis Worksheet to evaluate the process of assembling an electrical wire harness.
- Analyze the data collected to identify which ergonomic stressors are contributing factors to employee musculoskeletal disorder complaints.

To assemble an electrical wire harness, an electrician must take the following steps:

1. Set up the workstation based on the customer requirements for the electrical wire harness. To limit employee movements and steps, Company XYZ provides a toolbox station. The tool box is easy to slide because of the wheels and is also height adjustable. The electrician ensures that all equipment needed for the job is stocked inside the toolbox and then slides the toolbox to close proximity of the workstation. At the workstation is a three-foot slidable stool/ chair with minimal back support. The stool is provided by the company to minimize employee reach when attaching electrical wires to the harness.
2. Lay the 23-foot-long base of the harness on the ground. The base of harness is required to be stretched out on a flat surface. The base is dropped to the ground with the electrician sliding down the base to ensure it is in a straight line.

3. While sliding down the 23-foot-long base of the harness, the electrician must stop every 6-12 inches to zip tie smaller wires individually to the base. The electrician must grab a handful of zip ties and slide down the harness base. Each time the electrician makes it back to the beginning, another handful of zip ties must be grabbed.
4. After all the wires are attached individually to the base, the electrician must slide down the base one more time to zip tie all the wires collectively to the base. This is done by grabbing a handful of zip ties then proceeded down the line to tie wires every 6-12 inches.
5. Once all attachments are completed, the electrician slides down the base one last time to ensure that the electrical wire harness is up to Company XYZ standards and fulfills the customer's request.

During each step of this process, every movement was document to categorize within the task analysis sheet.

**Movements/Classifications (Step 1)**

Each movement from step 1, along with the associated classification status from the task analysis sheet was categorized as follows:

- Exerted slight force to push the toolbox to the workstation less than 10 times – ideal (material handling)
- Exerted slight force to push the stool/chair to the workstation less than 10 times – ideal (material handling)
- Sat on the stool/chair to begin assembling the electrical wire harness – warning (contact stress) warning (sitting posture)

**Movements/Classifications (Step 2)**

Each movement from step 2, along with the associated classification status from the task analysis sheet was categorized as follows:

- Exerted minimal force to lower the base to the ground – ideal (material handling)
- Exerted minimal force with legs to slid down the line of the base to ensure it was straight – ideal (force)
- While sliding, employee had to reach down more than 45 degrees more than 4 times per minute to straighten the base – take-action (reach)
- Pressure points from the edge of the chair/stool at the hamstrings warning (contact stress)

**Movements/Classifications (Step 3)**

Each movement from step 3, along with the associated classification status from the task analysis sheet was categorized as follows:

- Hands were in power grip position while exerting minimal force to grab and hold zip ties – ideal (force)
- Reaching and Bending more than 45 degrees from the stool/chair to the harness' base on the floor – take-action (reach)
- Sitting in the stair/stool position for extended time – warning (posture)
- Pressure points from the edge of the chair/stool at the hamstrings – take-action (contact stress)
- Hands in pinch position when tying wires together every 6-12 inches - warning (force) take-action (static loading) (repetition)

**Movements/Classifications (Step 4)**

Each movement from step 4, along with the associated classification status from the task analysis sheet was categorized as follows:

- Hands were in power grip position while exerting minimal force to grab and hold zip ties – ideal (force)
- Reaching and bending more than 45 degrees from the stool/chair to the harness' base on the floor – take-action (reach)
- Sitting in the stair/stool position for extended time – warning (posture)
- Pressure points from the edge of the chair/stool at the hamstrings – take-action (contact stress)
- Exerting minimal for to zip tying every 6-12 inches – take-action (static loading) (repetition)
- Hands in pinch position when exerting less than 2 pounds of force tying wires to the base – warning (force)
- Once all wires are attached individually to the base, employee slid down the base to attach (zip tie) the entire bundle (base and wires) together every 6-12 inches – warning (force)

**Movements/Classifications (Step 5)**

Each movement from step 1, along with the associated classification status from the task analysis sheet was categorized as follows:

- Reaching and bending more than 45 degrees from the stool/chair to the harness on the ground – take-action (reach)
- Sitting in the stair/stool position for extended time – warning (posture)

- Pressure points from the edge of the chair/stool at the hamstrings warning (contact stress)

Table 1 shows how movements from the five steps were graded by risk factor levels: ideal, warning, or take-action.

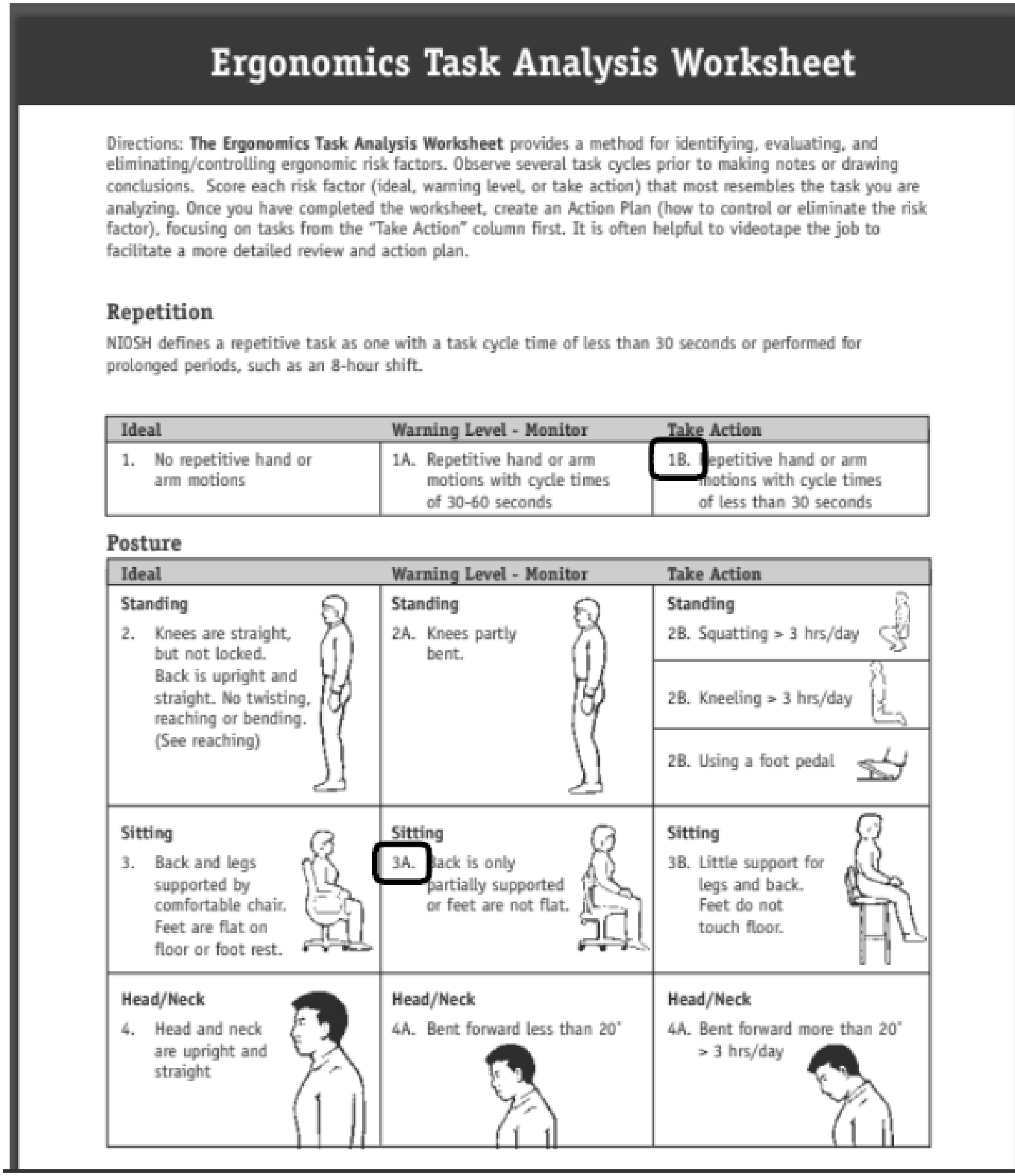
Table 1

*Ergonomic Stress Factors Grading Scale*

| Stress Factor | Ideal | Warning Level | Take Action |
|---|---|---|---|
| Repetition | | | II |
| Posture | | IV | |
| Lifting & Material Handling | III | | |
| Reach | | | IV |
| Force | II | III | I |
| Static Loading & Fatigue | | | II |
| Pressure/Contact Stress | | III | II |

**Item Analysis**

The Summary Worksheet shows the overall scoring of the task of assembling an electrical wire harness. During each step, ergonomic stress factors were combined to quantify the employee's exposure to the following ergonomic stress factors: repetition, force, lifting and material handling, static loading, posture, reach, contact stress, and the environment (see Figures 1 through 7).



# 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

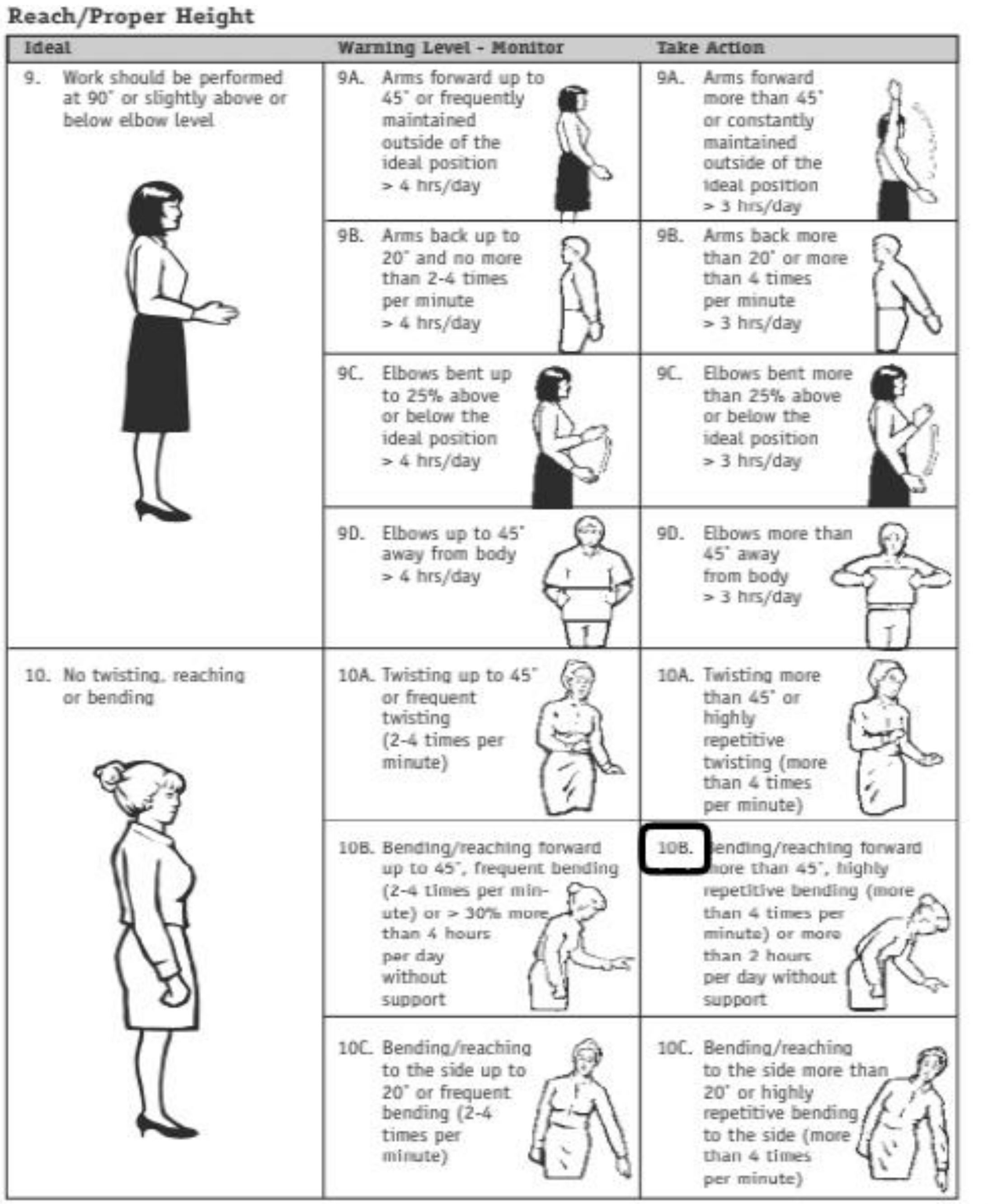
NIOSH defines a repetitive task as one with a task cycle time of less than 30 seconds or performed for prolonged periods, such as an 8-hour shift.

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

*Figure 1.* Ergonomic task analysis page 1.

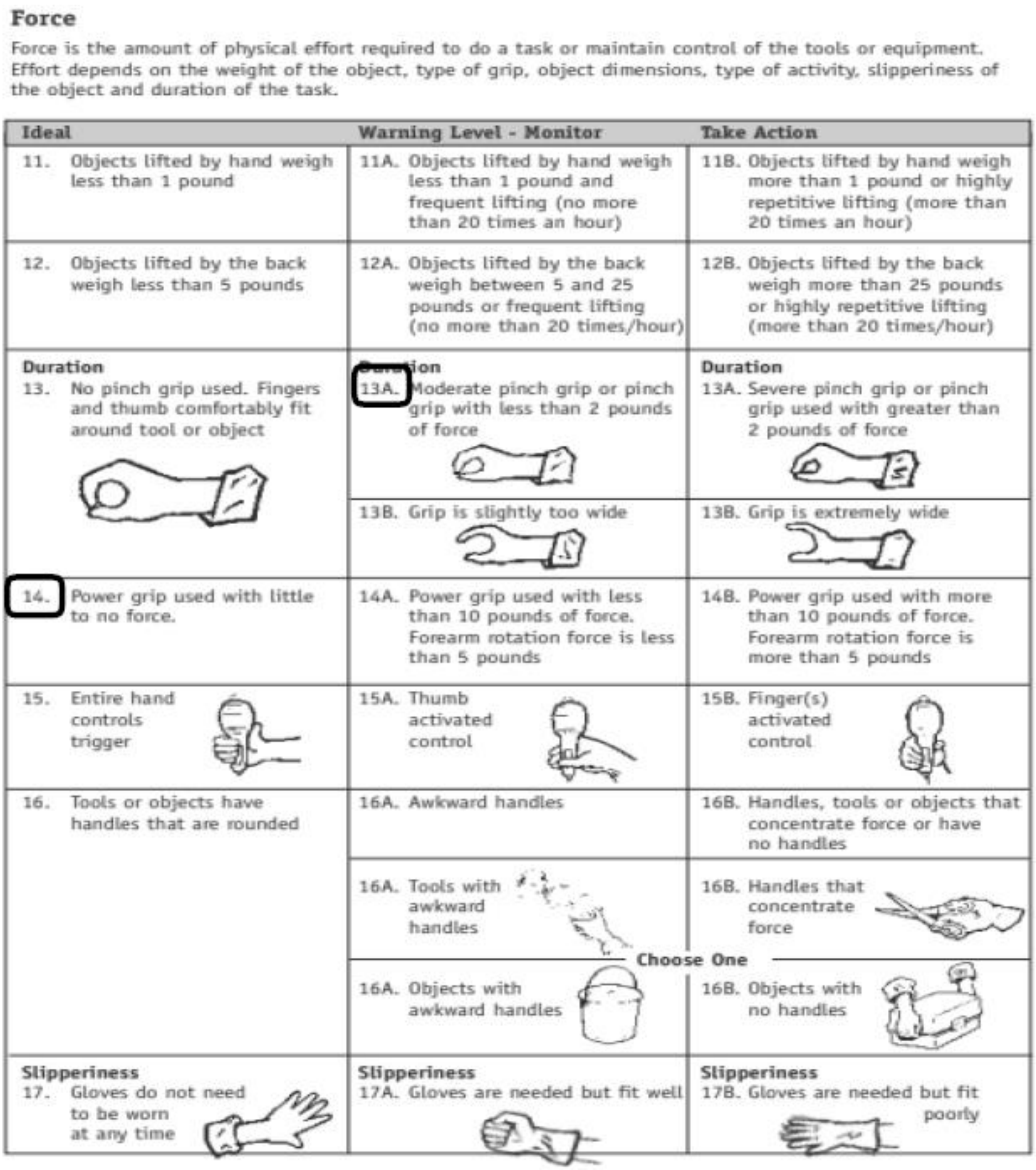


**Reach/Proper Height**

| 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) |

3

*Figure 2.* Ergonomic task analysis page 2.



**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 |

*Figure 3.* Ergonomic task analysis page 3.

## 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**<br>18. Constant position, tool or object is held less than 6 seconds | **Duration**<br>18A. Constant position, tool or object is held 6 to 10 seconds | **Duration**<br>18B. Constant position, tool or object is held more than 10 seconds |
| **Repetition**<br>19. Less than 25% of the task is repetitive | **Repetition**<br>19A. 25% to 50% of the task is repetitive | **Repetition**<br>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**<br>22. No pushing or pulling of carts or materials | **Push/Pull**<br>22A. Pushing or pulling 10-50 carts per shift | **Push/Pull**<br>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. |

*Figure 4.* Ergonomic task analysis page 4.

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

**Comments:** Employee 1 takes a break from reaching and bending over every 15-20 minutes. When asked why, employee 1 stated, taking a break to walk around relieves tension in the back and legs. Employee also suggested that the over excessive bending and reaching was the most stressful part of assembling an electrical wire harness and wanted the observor to really pay attention to that part of the task.

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



*Figure 5.* Ergonomic task analysis page 5.

**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 |

*Figure 6.* Ergonomic task analysis page 6.

**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: April 19, 2019 Date Solution to be Completed ______________

Location/Department: Confidential / Assembly Line

Job/Task Title: Production / Assembly line electrician

Evaluator: Anthony Hendricks

Describe MSD in previous 24 months: back and shoulder achs, stiffness in the hamstrings and knees and lower back.

Task: Assembling an electrical wire harness

Summary of Problem: Repetition, reaching and bending for long periods to assemble an electrical wire harness.

Alternative Solution and Costs: ______________

Recommended Solution: 1) Engineering Provide an adequate adjuctable table to assemble the electrical wire harness on.

2) Administrative: Provide a 2 person percedure to assemble the electrical wire harness.

3) Use of personal protective equipment N/A

Date Solution Actually Completed: ______________ Actual Cost: ______________

*Figure 7.* Ergonomic task analysis page 7.

**Summary**

The Summary worksheet shows how each applicable ergonomic stress factor was graded by the following three risk-level categories. Each category describes why the employee's movements are ideal, warning, or take-action. For the "Ideal Level," the stress factors were:

- Force (1)
- Lifting and material handling (1)
- Environment (5)

For the "Warning Level," ergonomic stress factors were:

- Posture
- Force
- Lifting and material handling
- Environment

For the "Take-Action Level," ergonomic stress factors were:

- Repetition
- Reach
- Static Loading (2)
- Contact Stress

# Chapter V: Discussion, Conclusion, and Recommendation

The purpose of this study was to evaluate the job tasks of an assembly line employee electrician who must assemble an electrical wire harness to determine mitigation methods for the ergonomic stress factors associated with the job.

## Research Objectives

The goals that guided this study were:

- Use the Ergonomic Task Analysis Worksheet to evaluate the process of assembling an electrical wire harness.
- Analyze the data collected to identify which ergonomic stressors are contributing factors to employee musculoskeletal disorder complaints.

## Methodology

This researcher used the Ergonomic Task Analysis Worksheet to evaluate the process of assembling an electrical wire harness to breakdown each of the employee's movements into the following ergonomic stress factor categories: repetition, posture, lifting and material handling, reach, force, static loading and fatigue, and pressure/contact stress.

After collecting data from the ergonomic task analysis worksheet, the data was analyzed to identify which ergonomic stressors are contributing factors to employee's musculoskeletal discomfort. Each step associated with assembling an electrical wire harness was scored into ideal, warning, and take-action categories. Doing so provided a hierarchy for the steps that need to be abated as soon as possible compared to the ideal steps ranked much lower in the list.

## Discussion

Company XYZ is a steel manufacturing company that produces and distributes street sweepers. The facility hosts a wide range of office and plant employees. Plant employees are tasked with the production of the street sweepers. The production process is divided step-by-step from start to finish of each street sweeper.

The steps to building a street sweeper include mailing and receiving, welding, painting, then the assembly line of merging the parts together, and lastly, testing the finished product. Each step is an intricate piece to delivering quality products, not only performing as expected, but also visually appealing to assist with continuous sales. Towards the end of production, assembly line workers are tasked with assembly an electrical wire harness that controls the features to each street sweeper. Assembling an electrical wire harness can vary for completion time depending on customer's request for different features. On average to complete the street sweeper it takes 120 minutes. To briefly describe the procedure, only one assembly-line employee can assemble an electrical wire harness at a time. That employee at the time is required to follow these steps:

- Check to see customer's request
- Layout base of the harness on the floor
- Individually attach smaller wires every 6-12 inches to the base by zip tying them
- Attach all wires collectively to the base every 6-12 inches by zip tying them
- Double check to ensure finished electrical wire harness meets customer's request

After completing an electrical wire harness, assembly line employees had been experiencing discomfort in their neck, back, shoulders, and knees, which led them to file complaints with Company XYZ. Currently, Company XYZ does not have metrics in place to provide quantifiable data that narrows down which movements caused the employees discomfort. If left untreated, employees will continue to aggravate the areas of discomfort that lead to nagging musculoskeletal injuries.

Musculoskeletal injuries are injuries or pain within the musculoskeletal system. Some common musculoskeletal disorders are carpal tunnel syndrome, back disability, and rotator cuff tendonitis. These types of injuries can be mitigated if caught at an early stage. One way of early detection is for companies to have a successful ergonomics plan in place. Ergonomics is an applied science and focuses on the design of equipment to fit the majority of people who must interact with it (OSHA, 2000). The six core elements for a successful ergonomics program are management commitment, employee involvement, identification of problem jobs, analyzing and developing controls for problem jobs, training and education, and medical management (Monroe, 2006). As previously stated, Company XYZ has been missing a core component to a successful ergonomic plan, which is analyzing and developing controls for problem jobs. This component provides methods to produce quantifiable data that can lead to a meaningful solution.

The Ergonomic Task Analysis Worksheet, created by the Great American Insurance Company (2004), categorizes the most common risk factors to observe when evaluating high-risk jobs that can lead to musculoskeletal disorders. The risk factor categories include repetition, posture, vibration, reach, force, static loading and fatigue, contact stress impacts, lifting and materials handling, and the environment. Within the categories, the assessor must score each risk factor as ideal, warning level, or take-action. Ideal is considered as acceptable, and no changes are required. Warning level categorizes the action/task as being acceptable but with some areas of concern that can lead to injuries down the line. Take-action items are high risk actions/task an employee is performing that draws serious concern to their safety and should be abated as soon as possible. The Ergonomic Task Analysis Worksheet was essential in evaluating potential MSD concerns associated with the assembly of the electrical wire harness for Company XYZ's employee.

**Conclusions**

After utilizing the Ergonomic Task Analysis worksheet to guide observations while a first-shift employee electrician assembled the electrical wire harness, enough quantifiable data was collected to identify the ergonomic stress factors and the high-risk movements associated with assembling an electrical wire harness. The "Ideal Level" ergonomic stress factors and movements were as follows:

- Lifting and material handling
- Force
- Environment

The ideal level is considered as acceptable, and no changes are required. Lifting and material handling is ideal because the employee exerted only slight force to push the toolbox to the workstation less than 10 times, exerted slight force to push the stool/chair to the workstation less than 10 times, and exerted minimal force to lower the base to the ground. Force is ideal because the observed employee's hands were in a power grip position while exerting minimal force to grab and hold zip ties. Environment is ideal because the employee had adequate control over the workstation, the lighting was adequate for the task, the temperature of the plant was comfortable, and work area was quiet.

The "Warning Level" ergonomic stress factors and movements were as follows:

- Posture
- Lifting and material handling force
- Environment

The warning level categorizes the action/task as being acceptable but with some areas of concern that can lead to injuries down the line. Warning level categories, if caught early, can be abated before the exposure to the employee gets any worse. Posture was categorized as a warning level during the observation because the employee sat in the stair/stool position for extended time with little to no back support. The employee had to sit for over a third of the time while assembling the electrical wire harness, which added up to approximately 90 minutes. Contact stress was categorized as a warning level because while the employee sat in the chair, their hamstrings were at the edge of the metal chair. Force was categorized as warning level because the employee's hands were in a pinch position while exerting less than two pounds of force tying wires together every 6-12 inches. Environment was categorized as warning level because the concrete flooring contributed slight stress to the back and legs.

The "Take-Action Level" ergonomic stress factors and movements were as follows:

- Reach
- Repetition
- Static Loading
- Contact Stress

Take-action items were high risk actions/task an employee was performing that draws serious concern to their safety and should be abated as soon as possible. The employee continuously had to bend and reach more than 45 degrees throughout the 2-hour task of assembling an electrical wire harness. Repetition was graded take action because of the repetitive hand motions the employee had to make to zip tie each individual wire to the base, then as a group to the base. Similar to the repetition category, static loading was graded take action because more than 50% of the task is repetitive. Contact stress was graded take-action because of the constant pressure on the employee's hamstrings from sitting on the stool/chair.

**Recommendations**

Following the risk-level hierarchy, the take-action recommendations will be first followed by the warning level recommendations. Lastly, comments made explaining the ideal level justify why those ergonomic stress factors for electricians assembling the electrical wire harness the are acceptable if kept under control. Each ergonomic stress factor was given either an engineering control recommendation or an administrative control recommendation. Engineering control is focused on the design of the equipment to better fit the employee using it, which helps omit or significantly reduce the employee's exposure to risk. An administrative control focuses on the changes within the procedure the employer can adjust to mitigate the employee's exposure to risk.

The following ergonomic stress factors are eliminated by using the Translyft double horizontal lifting table to assemble an electrical wire harness:

- Reach (take-action)
- Contact stress (take-action)
- Lifting and material handling (warning)
- Posture (warning)

The Translyft table (see Figure 8) is adjustable by both height and length. The table lifts as high as 6 feet and lowers to ground level. The table can extend horizontally as much as 14 feet (Translyft, 2019). The lifting and lowering feature will eliminate employees reaching or bending forward more than 45 degrees when assembling an electrical wire harness. The extension feature of the table helps to have a flat surface to assist with keeping the electrical wire harness straight, assisting with the mitigation of lifting and lowering the base of the electrical wire harness.

Purchasing a Translyft table will also assist with the mitigation of another take-action ergonomic stress factor, which is contact stress. Contact stress is considered take-action because the observed employee's hamstrings were constantly at the metal edge of the stool. By having an adjustable table, the employee is not required to sit on the stool the entire time and can adjust the table to standing height to relieve stress. When the employee is required to sit on the stool, he or she does not have to reach or lean forward more than 45 degrees, because the table can lift or lower to employee's one preferred setting. Having the adjustable table will improve employee posture, which was graded at a warning level.


*Figure 8.* Translyft double horizontal lifting table.

The following ergonomic stress factors could be eliminated by utilizing the AT3080:

- Repetition (take-action)
- Static loading (take-action)
- Force (warning)

The AT3080 (see Figure 9) is an automatic zip tying gun that specializes in increasing productivity while reducing manual labor (Hellermann Tyton, 2019). Repetition and static loading are take action because the observed employee has to zip tie wires individually to the base of the electrical wire harness every 6 to 12 inches. While zip tying, the employee exerts slight force continuously while their hands are in the pinch-grip position.

To eliminate the employee's exposure to the repetition, static loading, and force, it is recommended that Company XYZ purchase an AT3080 auto tool. By automating this process, the Company XYZ will eliminate the static loading build up from the employee constantly repeating the zip tying motions and eliminate the employee's hands being in the pinch-grip position at all. To purchase, refer to the AT3080 link on the reference page.


*Figure 9.* The AT3080.

The following ergonomic stress factor is reduced when utilizing the custom runner mats:

- Environment

The custom runner mats (see Figure 10) are specially designed anti-fatigued mats that provide more comfort to employees having to be on their feet for an extended period of time (ErgoWorks, 2019). The mat will reduce the stress the concrete floor adds to employees when having to stand.

To purchase the custom runner mat, refer to the link on the reference page.

*Figure 10.* Custom runner mats.

The following ergonomic stress factors are ideal and do not need an action plan:

- Force
- Lifting and material handling
- Environment

The observed employee demonstrated ideal force while holding zip ties in power-grip hand position. The employee exerted slight force to push and pull the cart to the work station, which is why lifting and material handling is graded ideal for this task. Lastly, the employee’s environment is ideal because the lighting is adequate for the task, the temperature is comfortable, the work area is quiet, and the floor provides adequate traction.

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## Appendix A: Great American Insurance Company Ergonomic Task Analysis Worksheet

# Ergonomics Task Analysis Worksheet

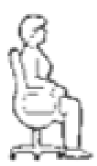
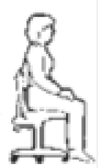
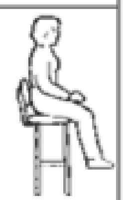
Directions: **The Ergonomics Task Analysis Worksheet** provides a method for identifying, evaluating, and eliminating/controlling ergonomic risk factors. Observe several task cycles prior to making notes or drawing conclusions. Score each risk factor (ideal, warning level, or take action) that most resembles 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

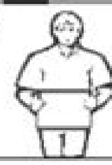
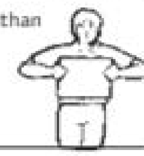
NIOSH defines a repetitive task as one with a task cycle time of less than 30 seconds or performed for prolonged periods, such as an 8-hour shift.

| 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 |

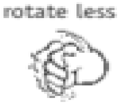
### Posture

| Ideal | Warning Level - Monitor | Take Action |
|---|---|---|
| **Standing**<br>2. Knees are straight, but not locked. Back is upright and straight. No twisting, reaching or bending. (See reaching)  | **Standing**<br>2A. Knees partly bent.  | **Standing**<br>2B. Squatting > 3 hrs/day <br>2B. Kneeling > 3 hrs/day <br>2B. Using a foot pedal  |
| **Sitting**<br>3. Back and legs supported by comfortable chair. Feet are flat on floor or foot rest.  | **Sitting**<br>3A. Back is only partially supported or feet are not flat.  | **Sitting**<br>3B. Little support for legs and back. Feet do not touch floor.  |
| **Head/Neck**<br>4. Head and neck are upright and straight  | **Head/Neck**<br>4A. Bent forward less than 20˚  | **Head/Neck**<br>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**<br>4. Head and neck are upright and straight<br> | **Head/Neck**<br>4B. Bent back less than 10°<br> | **Head/Neck**<br>4B. Bent back more than 10°<br> |
| | 4C. Bent sideways less than 20°<br> | 4C. Bent sideways more than 20°<br> |
| | 4D. Twisting neck less than 20°<br> | 4D. Twisting neck more than 20°<br> |
| **Ideal** | **Warning Level - Monitor** | **Take Action** |
| **Hands**<br>5. Palms are vertical (handshake position)<br> | **Hands**<br>5A. Hands rotate less than 20°<br> | **Hands**<br>5A. Hands rotate more than 20°<br> |
| **Wrists**<br>6. Wrists are straight<br> | **Wrists**<br>6A. Wrists are bent between 5 and 30 times per minute and bent less than 20°<br> | **Wrists**<br>6A. Wrists are bent more than 30 times per minute or bent more than 20°<br> |
| | 6B. Wrists move sideways between 5 and 30 times per minute and less than 20°<br> | 6B. Wrists move sideways more than 30 times per minute or more than 20°<br> |

**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**<br>13. No pinch grip used. Fingers and thumb comfortably fit around tool or object  | **Duration**<br>13A. Moderate pinch grip or pinch grip with less than 2 pounds of force  | **Duration**<br>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**<br>17. Gloves do not need to be worn at any time  | **Slipperiness**<br>17A. Gloves are needed but fit well  | **Slipperiness**<br>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**<br>18. Constant position, tool or object is held less than 6 seconds | **Duration**<br>18A. Constant position, tool or object is held 6 to 10 seconds | **Duration**<br>18B. Constant position, tool or object is held more than 10 seconds |
| **Repetition**<br>19. Less than 25% of the task is repetitive | **Repetition**<br>19A. 25% to 50% of the task is repetitive | **Repetition**<br>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**<br>22. No pushing or pulling of carts or materials | **Push/Pull**<br>22A. Pushing or pulling 10-50 carts per shift | **Push/Pull**<br>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**<br>24. Worker has adequate control over work pace. | **Work Pace**<br>24A. Worker has some control over work pace. | **Work Pace**<br>24B. Worker has no control over work pace. |
| **Lighting**<br>25. The lighting is adequate for the task. | **Lighting**<br>25A. The lighting is slightly too bright or too dark for the task. | **Lighting**<br>25B. The lighting is significantly too bright or too dark for the task. |
| **Temperature**<br>26. The temperature is comfortable. | **Temperature**<br>26A. The temperature is slightly too cold or too hot. | **Temperature**<br>26B. The temperature is significantly too cold or too hot. |
| **Noise**<br>27. The work area is quiet. | **Noise**<br>27A. The work area is slightly noisy. | **Noise**<br>27B. The work area is significantly noisy (too noisy to carry on a conversation). |
| **Floor Surface**<br>28. The flooring provides good traction.<br><br>29. The flooring is sufficiently padded to relieve stress on back and legs.<br><br>30. Floor mats are provided to relieve stress on back and legs. Employee can alternate between sitting and standing. | **Floor Surface**<br>28A. The flooring is slightly slippery.<br><br>29A. The flooring contributes slight stress to the back and legs.<br><br>30A. Standing 0-50% of time without floor mats or other means to relieve stress on back and legs. | **Floor Surface**<br>28B. The flooring is moderately to extremely slippery.<br><br>29B. The flooring contributes moderate to extreme stress to the back and legs.<br><br>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.

## 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 B: IRB Consent Form

### Consent to Participate In UW-Stout Approved Research

**Title:** *An Evaluation of Ergonomic Stress Factors at Company XYZ*

**Research Sponsor:** *John Dzissah (715-232-1265) 246 Jarvis Hall-Tech Wing*

**Investigator:**
*Anthony Hendricks Jr.*
*(773-750-3697).*

**Description:**
*The purpose of this research is to identify the ergonomic stress factors associated with assembling an electrical wire harness at Elgin Sweeper. Ergonomic stress factors can include: awkward postures, repetitive motions, and excessive reaching. Identifying ergonomic stress factors can prevent musculoskeletal injuries. To identify the ergonomic stress factors associated with assembling an electrical wire harness I plan to observe the assembly line employee that is assigned with the wire harness task. I will observe by following guidelines on the Liberty Mutual Ergonomic Task Analysis Worksheet. Utilizing this worksheet will help pinpoint the motions that are causing aches, strains, or stiffness, also known as ergonomic stress factors. Once the motions are pinpointed I can then research mitigation methods to limit or eliminate the motions within the task that are contributing to the stress factors.*

**Risks and Benefits:**
*The minimal risk perceived during my observation would be the discomfort (stiff neck/back & shoulder strains) of the employee assembling the wire harness. The observed employee will benefit because he will know exactly what motions during the task are causing their discomfort. Also, once the motions are pinpointed a mitigation plan to limit or eliminate those motions will follow.*

**Time Commitment:**
*The time frame will be one day or the amount of time it takes to finish one electrical wire harness.*

**Confidentiality:**
*I will not include your name or your employer on any of the documents. This informed consent will only be seen by myself, your EHS manager, and the UW-Stout IRB and not turned in with any other documents.*

**Right to Withdraw:**

*Your participation in this study is one-hundred percent voluntary, you can decline participation without any consequences. If you choose to participate and down the line decide to withdraw your participation, you have the right to do so without any consequences.*

**IRB Approval:**

This study has been reviewed and approved by The University of Wisconsin-Stout's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by federal law and University policies. If you have questions or concerns regarding this study please contact the Investigator or Advisor. If you have any questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Administrator.

**Investigator:** *Anthony Hendricks Jr., 773-750-3697, hendricksa7979@my.uwstout.edu.*

**Advisor:** *John Dzissah, 715-232-1265, dzissahj@uwstout.edu.*

**IRB Administrator**
Elizabeth Buchanan
Office of Research and Sponsored Programs
152 Vocational Rehabilitation Bldg.
UW-Stout
Menomonie, WI 54751
715.232.2477
Buchanane@uwstout.edu

**Statement of Consent:**

By signing this consent form you agree to participate in the project entitled, "***An Evaluation of Ergonomic Stress Factors at Company XYZ***."

_______________________________________________________

Signature Date