AN ERGONOMIC EVALUATION AND ANALYSIS FOR IDENTIFYING CUMULATIVE TRAUMA EXPOSURES IN THE OFFICE WORKPLACE

By

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Table of Contents

CHAPTER ONE

STATEMENT OF THE PROBLEM

Introduction

In the workforce today, computer use causes some individuals to experience physical disorders which range from simple fatigue to permanent disabilities (Pasher, 1997). Some of the more common office-related physical disorders are: Carpal Tunnel Syndrome, tennis elbow, lower back strain, etc. Such disorders are often aggravated further with the office desk/chair set-up and design. The discipline of ergonomics is designed to address, and hopefully mitigate such issues by examining the relationship between humans and their work.

Company XYZ is a law office and legal system business with 16 employees. In the various positions, associated employees are required to spend a large amount of time interfacing with computers, as well as on the telephone, while seated in their respective cubicles. As a result of these activities, there have been a growing number of complaints, especially from one employee, concerning the occurrence of pain in her lower back area, wrists and neck.

Purpose of the Study

The purpose of this study was to identify office-type ergonomic risk factors facing certain employees at XYZ Company, and to develop a problem evaluation and analysis to be used in reducing Cumulative Trauma Disorder symptoms and lower back pain experienced by these employees.

Goals of the Study

The goals of this study were to: (1) identify the risk factors facing XYZ employees by the continued usage of computers and other equipment in the office environment, and (2) to administer an employee symptom survey, along with a job station analysis.

Background and Significance

Cumulative trauma injuries, stress/strain injuries and associated disorders are a prevalent force in the world of work today. For employees and their firms, this area is remembered in two words only: pain and cost. Claims of musculoskeletal injuries now often include those that involve repetitive hand and wrist injuries from working at computer workstations- such as the highly-publicized carpal tunnel syndrome, and neck, arm, shoulder and back injuries (Pasher, 1997). Claims of eye injuries that may be caused by work at visual terminals, such as eye-strain, are becoming more prevalent as well (Pasher, 1997).

This type of loss that results in a worker compensation claim represents a "sunk" cost, where there is little or no utility value for the company on this type of cost. Productivity loss, morale, and humanitarian issues come into play if pro-active measures are not taken to prevent this static loss.

Definition of Terms

Anthropometry- The study of human physical dimensions.

Carpal Tunnel Syndrome (CTS)- Repetitive flexing of the wrist, particularly in combination with forceful exertions, causing irritation and swelling of synovial membranes that lubricate the tendons in the carpal tunnel; the swelling causes nerve compression.

Ergonomics- A field of studying principles of physiology and psychology to examine the relationship between the worker or group of workers and tasks, tools, support equipment, and physical and environments with the objective to provide effective and efficient recommendations for reducing the frequency and severity of musculoskeletal injuries and illnesses.

Illness: Any condition or disorder caused by exposure to environmental factors associated with employment.

Injury: Any hurt, harm or impairment to the body which arises out of or during the course of employment.

Risk Factors: Exposures which increase the likelihood or chance of an injury or loss.

CHAPTER TWO

REVIEW OF LITERATURE

Introduction

The Purpose of the review of literature is to examine and evaluate literature which is relevant to the development of an office ergonomic problem evaluation and analysis. The literature review is segmented into the following categories:

1. Overview of cumulative trauma disorders
2. Evaluation of existing office ergonomic assessments
3. Review of Occupational Safety and Health Administration's proposed Ergonomic Protection Standard.

Overview of Cumulative Trauma Disorders and Lower Back Strain

Recognition that work may adversely affect health was recorded more than 200 years ago by an Italian physician, Bernardo Ramazinni (Putz-Anderson, p. 1). He identified two types of workplace hazards: the "harmful character of the

materials handled" and the "certain violent and irregular motions and unnatural postures of the body, by reason of which the natural structure of the of the vital machine is so impaired that serious diseases gradually develop therefrom" (Putz-Anderson, 1988, p. 1).

The first hazard Ramazinni mentioned could be explained today as exposure to hazardous materials in the field of industrial hygiene and environmental control technology (Putz-Anderson, 1988, p. 1). The second hazard Ramazinni describes as "irregular motions and unnatural postures" is equivalent to the current problem of cumulative trauma disorders (CTD's). Until recently, CTD's attracted very little (if any) attention from the public or employees, much less any regulatory interest (Courtney, 1998). However, there is sufficient documentation from early medical records that indicate that CTD's were present. The review of past medical records show that experienced tradesmen suffered from a variety of musculoskeletal disorders (Putz-Anderson, 1988). Often ailments were named after the profession or trade; i.e., "bricklayers shoulder", "carpenter's elbow", "stitcher wrist", and "game keepers thumb" (Hunter, 1978).

The primary obstacle that contributed to the lack of awareness or concern by the public (or employers) in the past was the lack of reliable measurement and proper documentation of these disorders (Putz-Anderson, 1988). These types of

disorders are tracked far more efficiently today than in the past, which were drawn from data bases not designed for this type of information, and consequently provided only limited insight into the CTD problem. These reports combined with the findings from the individual work sites, office work sites, clinics, etc., do suggest that the hazards described in Ramazinni's work as "irregular work motion

or unnatural postures of the body" account for an increasing amount to lost work time (Putz-Anderson, 1988).

Work-related musculoskeletal disorders (WRMD's) are now recognized as a major occupational health problem and are linked to jobs that are repetitive, require high focus, and require continuos or repeated extreme or awkward postures (Jones, 1998). The Bureau of Labor Statistics reports that upper extremity CTDs accounted for almost 60% of the 332,000 new cases of occupational illnesses reported in 1990 (LeBar, 1992). The number of office ergonomic-related claims and their associated costs had doubled between fiscal years 1994 and 1995 (Conway, 1998). These claims included repetitive motion, cumulative trauma disorders and injuries caused by improper workplace ergonomics, as well as improper lifting techniques. The bulk of worker compensation payments (75-85% in many companies) is spent for CTD lost time, medical, and disability costs. This does not take into account low-back pain, which is often a symptom found in conjunction with CTD's. Occupational low

back pain (LBP) costs U.S. Industry between $4.5 and $38 billion per year (Lee, 1994).

One may ask what this leading cause of human suffering and loss of productivity is on our compensation systems. Cumulative trauma, or repetitive motion disorders are diseases of the musculoskeletal and nervous system which may be caused or aggravated by repetitive motions, forceful exertions, vibration,

mechanical compression (hard and sharp edges), sustained or awkward postures or by exposure to noise over extended periods of time (US Department of Labor, Bureau of Labor Statistics, 1984). CTD's can affect nearly all tissues including the nerves, tendons, tendon sheaths, and muscles, with the upper extremities being the most frequently affected. These painful and sometimes crippling injuries develop gradually over a period of weeks, months, and years, and result from repeated actions such as twisting and bending the hands, arms, and wrists (Putz-Anderson, 1988). A common risk factor among these disorders is the use of force combined with repetitive motion over time (US Department of Labor, OSHA, 1991). The most common occupational illnesses associated with CTD's are tendon disorders such as tendinitis, tenosynovitus, DeQuervain's disease, trigger finger, Raynaud's syndrome and carpal tunnel syndrome (Putz-Anderson, 1988).

A significant reason for the large increase in CTD's is the increased pace of work, along with the growing interaction with computers. This type of

movement may be performed as many as 25,000 times in a workday, despite fatigue (Luopajarvi, et. all, 1979). Many people interact daily with computer keyboards and until the late 1800's, office work assumed a very small role for most businesses (Lueder, 1991). Workers in the 1980's witnessed the onslaught of the personal computer into the workplace. In the last ten years, no other form of technology has come close to matching the impact that computers have had on the American labor force. By the end of 1990, nearly 40 million people will

conduct their work using personal computers (Wallin, 1994). Not surprisingly, the increase in computer usage has led to an increase in reports of operator stress problems related to keyboard entry. The total number of recorded cases of repetitive motion injury has increased from 34,700 cases in 1984 to 332,000 cases in 1994 and represents nearly two-thirds of all workplace illnesses. These disorders include tenosynovitis, carpal tunnel syndrome, tendinitis, epicondylitis, and others. Currently, cumulative trauma disorders are considered the most costly and severe disorders occuring in the office work environment (Gerard, 1996). Because office workers may spend several hours at their work station, poorly designed equipment and workstations can create fatigue, discomfort, muculoskeletal stress and/or mental stress.

Occupational back injuries are a major problem in the United States (Garg, 1989). Aching backs area medical providers' valhalla. As much as $100 billion

each year is spent treating low back pain. Medical experts believe that while low back pain may manifest itself suddenly, it actually develops slowly over time for the vast majority of sufferers. Some 80 percent of Americans will experience at least one bout of low back pain before the age of 65 (Smith, 1996). Researchers like Stover Snook, Ph.D., Assistant Vice President and Director of Laboratories at Liberty Mutual Research Center for Safety and Health, admits that they cannot pinpoint the cause of back pain. They do not know if it originates in the muscles, vertebrae, ligaments, or discs of the back. They do not know that the effects are

cumulative, becoming more apparent as we age (Smith, 1996). Thus, while low back pain might be an inevitable condition for most of us, low back disibility is not.

Low back pain can be triggered by jobs which involve repetitive motion and tasks such as lifting, bending, and stretching. Redesign of the job or workstation when repetitive motion is a problem can greatly reduce strain on the lower back, said Pat McDermott-Caine, president of Ergoworks, Inc., Medford Ore. According to her, workstations tend to be designed for people who are a standard size of 5’6” to 5’10”. Employees who fall out of that range could potentially have a problem. Another mistake that is quite common for low back pain is when companies buy the same chair for all employees, even though people come in all heights and sizes.

Evaluation of Existing Office Ergonomic Assessment Tools

Cumulative trauma disorders may be called the disease of the 1990's. Dealing with ergonomics problems is not a luxury - it's a necessity that most companies realize they can't afford to be without (LaBar, 1991). As Mark D. Johnson, Eastman Kodak Corporate Ergonomics Director states, "If you expect to have a good safety and health program, there should be an ergonomics component. If there isn't, I would question if you have a good safety program at all". As a result, there are numerous materials related to CTD exposures in the office workplace and it is an immense task to search through the current literature

to find office ergonomic tools to be used by consultants in evaluating the degree of CTD hazards in their client's office workplace settings. Many of the tools that are available are lengthy, time consuming, or are in formats that are difficult to use (i.e., videotape). Most "multi-media" assessment formats did not become available until the mid to late 1980's, because of the advent of technology such as the VCR. Interestingly, one of the earlier, pioneering ergonomic assessment tools was developed by Leonard Ring in 1978 (Ring, 1978). Although this assessment tool seemed to be a comprehensive one in it's time, it's development for use in all industrial work environments would likely make it difficult to translate the risk assessment factors that pertain solely to office ergonomics.

A more recent evaluation tool is the "Task Evaluator" form which is a segment of an ergonomics training workbook produced by Safety Training Systems (Safety Training Systems, 1995). The assessment tool is geared for all facets of an industrial setting. It outlines the steps used to identify, analyze, and correct ergonomic-related problems; how to screen for ergonomic risk factors; and how to identify and implement solutions. To acquaint oneself with the assessment approach, one must watch four videos and read the entire workbook. One of it's advantages is that it covers a fairly large amount of situations, but the drawback is it's broad scope. It is not intended for those companies who want to focus just on office ergonomics.

Another tool used in the safety field is "RULA: A Survey Method for the Investigation of Work-Related Upper Limb Disorders" by Lynn McAtamney and E. Nigel Corlett. It is a survey method developed for use in ergonomics investigations of workplaces where work- related upper limb disorders are reported (Corlett and McAtamney, 1993). This tool requires no special equipment in providing a quick assessment of the upper extremities of the body. A coding system is used to generate an action list, which indicates the level of intervention required to reduce the risks of injury. Although lacking detail in scope, it is formatted to evaluate all industrial departments. An advantage of this

is that is is rather easy for companies to implement, but does tend to provide limited data to work with.

Recently, Pepsi-Cola has implemented a series of initiatives, including training, a focus on ergonomics and later, a system of regular reviews and assessments to monitor progress. One area of concern to Pepsi is the growing occurrence of cumulative trauma disorders. Pepsi relies on regular annual assessments of safety progress reviews at every one of the more than 100 market units. To conduct its progress reviews, Pepsi uses the International Safety Rating System (ISRS), which is a management tool and audit instrument developed by Det Norske Veritas Industry USA (DNV), an Atlanta-based loss-control mangement firm (Industry, 1997). Improvements that have come out of the loss control plan include new emphasis on ergonomics, work design, and equipment

design. Pepsi has developed training videos for each position in the company that not only teach job skills, but also job ergonomics.

Recently, some companies in the insurance industry as well as other industries have decided to take control of worker compensation costs by turning to the technology of multimedia-such as CD-ROMS and videotape to provide ergonomics training and workstation evaluations. For example, Seattle-based Safeco Insurance Cos. Has developed a new interactive mutimedia CD-ROM for office ergonomics training & assessments, allowing employees to train

themselves individually (Pasher, 1997). What is commendable about their system is that they are going beyond traditional safety programs and at the same time are educating employees in recognition and control of ergonomic risk factors.

Several sources available in the ergonomic literature come in videotape form. The videotapes are more educational in nature, rather than assessment guides. One such training package is "Safety Sense: Office Ergonomics" produced by Long Island Productions (Long Island Production Corporation, 1995) It is fairly thorough in it's description of adverse office environments and associated risk factors. Although these topics are essential in ensuring a safe office environment, the videotape does not offer a format to assist employees or consultants in determining the extent of CTD exposures in the office setting.

A second videotape used in many of today's office training programs is "3M Office Ergonomics: Putting It All Together" (3M Commercial Office Supply

Division, 1996). The training format of the videotape provides a broad spectrum of ergonomic solutions to address the physical, environmental, and psychosocial needs of office workers. The videotape also offers suggestions for office equipment and products designed by 3M to assist in workplace redesign. 3M does an excellent job of displaying professional controls of ergonomic solutions, both administrative and engineered, but at times the tape tends to be a marketing tool for their safety-oriented products.

Symptom Surveys

Ergonomists are often asked for input on injury prevention and reduction programs. When consulting for a company, their initial questions tend to concern present or past "cases" and the risk factors that contributed to employee injuries. (Frantis, 1999). Often, managers tend to adopt the philosophy of "If it ain't broke, don't fix it." In other words, managers do not discuss symptoms with employees if they have not first mentioned it. The managers would like to think that nothing is wrong, in hopes of preventing a claim. There seems to be a trend in the safety field today that harbors a fear about epidemics of cumulative trauma that prevents those charged with safety responsibilities from performing symptom surveys. (Frantis, 1999). A symptom survey is a one or two page document that includes a drawing of the human body with various areas for the employee to shade-in with regards to their ailing body parts. It also includes questions on the frequency of

pain, how much time on the job is spent in certain positions, and various other probing questions designed to address the nature of the ailment and it's severity.

According to OSHA's Ergonomics Program Management Guidelines for Meatpacking Plants (1990), symptom surveys are a required element of the medical management component of an ergonomics program. The two main

(stated) objectives of such surveys are to 1) determine which jobs exhibit ergonomic risks and 2) measure progress of an ergonomics program. OSHA recommends that these surveys be conducted on an annual basis and that they include a description of the location, frequency, and duration of employee discomfort, as well as a "body diagram." The agency also recommends that employees complete the surveys anonymously in order to encourage honest reporting and eliminate fear of repercussion (OSHA Reporter, 1994).

The American National Standards Institute (ANSI) also discusses symptom surveys within the broader context of "active surveillance" in its 1994 draft document, "Control of Work-Related Cumulative Trauma Disorders, Part 1:Upper Extremities" (ANSI-365). Again, the two primary objectives are to 1) assess the need for occupational safety and health action and 2) evaluate program effectiveness.

It is important to note that symptom surveys are considered a surveillance tool, not a screening tool. A surveillance tool is used to discover trends within an entire population; the trends are then addressed in a general way. A screening

tool is used with any one person to determine whether a specific problem exists (Frantis, 1999).

Advantages of symptoms surveys are many. Proponents who support the use believe they can help identify occupational groups with a high occurrence of

symptoms. This can alert management to "risky" jobs with the most need of engineering or ergonomic modifications. Fewer reports of symptoms reflect a successful ergonomics program. Symptom surveys are also considered a way to train employees about ergonomics and to monitor employee understanding of behaviors that can contribute to injuries and illnesses (Frantis, 1999).

There are some drawbacks to using symptom surveys. According to one author, even if trained, employees will not accurately describe symptoms; to rely on such information may not accurately identify those with CTD's (Katz, 1990). Workers respond differently to the same questions, depending on factors unrelated to the risk of CTDs. Also, psychosocial factors have been found to affect the accuracy of a worker's reports on symptom surveys. While clinical signs of CTD's are not affected by job satisfaction, workplace stress and other psychosocial elements, these factors will reportedly affect the extent of reported symptoms (Higgs, 1992).

Logistics/methodology of symptom survey

When the goal is to reduce musculoskeletal injury and/or illness, the employer must ask employees how their bodies feel when they perform their jobs.

Although this strategy will likely cause the rate of recordable injuries to increase, over the long term, it will enable management to identify ergonomic "hot spots" and reduce the severity of injuries (Frantis, 1997). Eventually, the injury rate will

decrease as well. Coupled with the typical symptom questions, a sketch of a human body will be on the survey for the employee to highlight problem areas. The employees subjective feelings on this subject is crucial in order to really "tap" into the effects of stress, work load levels, and workstation design on the human body.

Review of Proposed OSHA Standard

The summary of key provisions in the draft ergonomics protection standard contains information on how to set up an ergonomic program, control hazards, use medical surveillance, and address other ergonomic related issues. (OSHA, 1998). Although OSHA's draft pre-proposal for an ergonomics standard has not been put on the rulemaking table, it is an excellent guidance document. OSHA has invested considerable effort in the development of a more specific workplace ergonomics standard including the release of a draft proposed rule in March 1995 (Courtney, 1998). The approach of the draft appears to be performance-oriented with specific guidance in certain areas. It is consistent with international quality assurance activities, such as International Standards Organization (ISO) 9000. The draft incorporates continuous improvement in working conditions.

The main purpose of the proposed OSHA Ergonomics standard is to prevent the occurrence of work-related musculoskeletal disorders. Other objectives will be to

promote continuous improvement in workplace ergonomic protection, identify design principles that prevent exposure to risk factors, and to ensure ongoing and consistent management leadership and employees involvement. It is important when reviewing the OSHA document to keep in mind that this is only a guideline, and not a current mandate for employers to follow. The information in this standard is valuable for any company first trying to establish an ergonomic program, or who are trying to enhance their current one.

The major program elements of the draft pre-proposal are:

1) Identification of problem jobs
2) Fixing problem jobs
3) Employee involvement and training
4) Evaluating the effectiveness of the process (OSHA, 1998).

The OSHA draft pre-proposal for the ergonomics protection standard can be divided into six major sections. These sections include: scope and application, identification of problem jobs; control of risk factors; and training; medical management and record keeping. While the OSHA draft pre-proposal is not designed specifically for office settings, many elements of the draft are pertinent and helpful to those establishing office ergonomic safeguards.

CHAPTER THREE

METHODOLOGY

Introduction

The purpose of this section of the study is to evaluate Company XYZ with regard to the potential risk factors associated with the development of office employee cumulative trauma disorder related injuries. Although there are a fair number of assessment tools on the market intended to identify, address, and correct repetitive motion injuries, many are time-consuming in nature and are not designed specifically for evaluating the ergonomic safety of the office workplace design. Despite the increase in CTD injuries in office employees, little attention has been given to addressing office safety in a swift and efficient manner that meets the client's needs. Using the symptom survey feedback form as an independent standard, comparative analysis was performed between the reported ailments and the desktop design and layout.

Cowles XYZ was utilized for this study. This business was selected due to the fact that two employees have been experiencing physical ailments, ranging from neck strain/eye strain, to lumbar and wrist discomfort. The workstations located there are all standard issue, generic in design, and easily acessible through any office product catalog. Because of their limited ability to be adjusted, accommodating all sizes of people can be difficult.

Data collection:

Decision-making information was gathered by administering symptom surveys from the ailing employees, as well as collecting measurements of the workstation design/layout. The input given from the employee filling out the survey showed the type, location, nature, and severity of the strain or sprain. This study has attempted to design an evaluation and analysis using the following process.

Procedure:

1. Reviewed loss control data to determine the nature and extent of past ergonomic-related losses (if any) and current complaints voiced by employees.
    1.1 Review OSHA 200 logs (if applicable)
    1.2 Determine associated injury/illness costs
    1.3 Consulted with employees
2. Identified CTD and lower back strain as a source of employee complaints.
3. Obtained management support
    3.1 Define evaluation guide goals
    3.2 Review CTD costs
    3.3 Review evaluation and analysis program goals
        3.3.1 Develop a evaluation and recommendations for XYZ Company
4. Reviewed related literature critical to evaluation development
    4.1 Cumulative trauma disorders
    4.2 University of Wisconsin-Stout Library

5. Analyzed collected data to determine whether or not realistic recommendations could be made for improving the design/activities of the office from an ergonomic standpoint.

CHAPTER FOUR

THE STUDY

Introduction

This section of the study shall describe the data that was gathered in order to administer recommendations and arriving at conclusions for XYZ Company. These methods used to obtain the data are:

1. Task Analysis
2. Symptom Survey (ANSI, 1994)
3. Diagram of original workstation
4. Boise-Cascade Product Catalog

Task Analysis

A task analysis was implemented for this particular employee. A task analysis (or worksite analysis) is used to make determinations of whether or not there are problems. Various tasks were identified that were found to be repetitive, or adverse as far as posture and reach were concerned. Here is a breakdown of the daily tasks and risk factors associated with a typical day for the employees during the week:

Tasks	**Risk Factors**:
1.0 Pick up phone and check messages	None
2.0 Start-up computer and check daily planner	None
3.0 Attend any morning meetings	None
4.0 Start placing outgoing calls (20-25 a day)	Repetitive motion, posture
5.0 Mail marketing correspondence	Repetitive motion, posture
6.0 Fax any marketing correspondence	None
7.0 Receiving calls (15-20 a day)	Repetitive motion
8.0 Assembling marketing follow-up folders	None

It was found that many times, employee 1 would be making more than 25 outgoing calls and receiving over 25 incoming calls a day. This, in conjunction with spending approximately 85-90% of her time working on her computer, helped us identify reasons for her various plans and discomforts.

Symptom Survey

Employee 1 was asked to fill out a very thorough symptom survey, which can be found in the appendix. The survey was borrowed from the ANSI Z-365 Standard on Cumulative Trauma Disorders. It was determined from the feedback on the survey that there was a range discomfort. It was important to

note on the survey the various shaded areas on the human body where the employee was feeling pain and the frequency of said pain/strains.

Based on the overall responses, the results indicated that employee 1 not only felt physically exhausted after work, but often felt pain and discomfort that the employee believes is related to work. The symptoms of pain have been apparent for over a year, according to the feedback on the survey.

Diagram of workstation

A diagram of the original workstation is included on page # to show the current office cubicle layout, in order to help arrive at a valid conclusion for recommending alterations. Measurements were taken at various points to assist in identifying areas with a potential for adverse ergonomic concerns. Some measurements taken that are of issue were the distance of the mouse in relation to the user's reach, the height of the monitor, and the distance between the employee and the computer printer and paper trays.

Boise-Cascade Product Catalog

As for costing resources, the Boise Cascade Office Products catalog was referenced. It is a 1999 publication that furnishes ergonomic products that are very comprehensive in terms of content. A basic listing of the equipment includes: multi-functional chairs, articulating/ergonomic keyboards and

mouse drawers, foot turtles, copystands/glare reducers, monitor risers and adjustable desks. Everything that would be recommended with respect to equipment specifications and selections were concerned. Price, warranty, and quality were all factors considered when choosing this reference guide.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

Introduction

The purpose of this study is to assess and develop recommendations for XYZ Company to be used with current employees who experience symptoms possibly related to cumulative trauma injuries in the office workplace. These recommendations will allow XYZ Company to evaluate their employees' office work stations for comfort, safety, and ultimately, productivity.

Goals of the Study

The goals of the study are:

1. To provide an assessment for the company’s employees to accurately describe employee complaints of sprains and strains experienced.

2. To offer the employees an opportunity to identify in their office settings potential task related, work environment, and human factors that contribute to the development of repetitive motion disorders.
3. To assist the employees in reducing their potential for Workers' Compensation claims by identifying the ergonomic hazards in the office environment that are causing employee complaints.

Conclusions

The symptom survey developed by ANSI was administered. The survey is thorough, practical and easy to put into practice. The survey divided the human body into various body part areas; each with it's own column.

The risk factors gathered from complaints identified focus areas needed to prevent and control loss-producing exposures/risks. With the consistent and thorough identification of CTD exposures in the office setting, it is anticipated that the company's employees will be able to develop an action plan to reduce or minimize the identified exposures. With this in place, it is expected that the proper identification of office CTD's and the follow-up plan to address these exposures will be reflected in a reduction in the client's yearly Workers' Compensation claims.

Recommendations

1. Utilize existing equipment where feasible with alterations, adjustments, and modifications.

Advantages: *Decreased employer cost

*Appropriate use of company resources

*Employee familiarity with process and equipment

*Minimal training/retraining with new adjustments

Disadvantages: *Inability to engineer out all risk factors for CTDs

*Non-adjustable current equipment

*Lack of training with current equipment

*Exposure to injury likely in unaltered areas

2. Remove existing equipment and incorporate new ergonomic engineering at the majority of job aspects.

Advantages: *New ergonomic engineering controls incorporated at multiple facets of the workstation

*Loss and injury controlled more appropriately

*Greater visibility to train employees on the appropriate use of new equipment

*Increased employee comfort and productivity

*Material value-added to the company that could be lost to injury loss.

*Cost of modification greatly outweighs the probability for loss due to injury.

Disadvantages: *Initial cost of modification

*Business interruption at the time of implementation

Final Recommendation:

The final recommendation utilized the concepts, advantages and disadvantages of the previously listed options for loss control as the basis of modification justifications. The Boise-Cascade Company furnishes ergonomic products incorporated into this recommendation. Pictures, descriptions, and prices can be found in the Appendix.

Office Chair: Although the current chair does numerous adjustments for height, recline, and seat pan tilt, it is inadequate for low back support and encouraging appropriate sitting posture. The

chair does not allow the worker to adjust the height of the backrest, nor the angle of back support. To compensate for this lack of adjustability, employee 1 has taken attempts to remedy this situation by placing pillows at the location at the small of the back. This is recognized as a temporary fix and calls for immediate attention.

Recommendation: The Granada Multi-Function Chair is recommended for multiple reasons including its high degree of adjustability and reasonable cost. The chair has a forward tilt seat for data entry that is of great benefit to our business due to the high

amounts of data entry which are performed at the computer workstations. The chair has the following characteristics:

*Compound curve back design plus lumbar back cushion

*Pneumatic seat adjustment, 17" to 22"

*Infinite tilt lock control, with tilt tension

*Forward tilt feature for data entry

*Back angle and height adjustments

*Adjustable height urethane arms

Cost: $459.00

Keyboard and Mouse Drawer: The current keyboard drawer takes advantage of the ability to use the under-desk space as room for keyboard storage and bringing the keyboard closer to the user. Although this assists the user with keyboard operation, it places the employee at great risk when using the mouse on the desktop. With the mouse on the sharp edge of the desk while reaching forward 7" (30°) from the frontal plane and upward 6" to grasp the mouse. This arm extension and flexion has created shoulder and wrist pain to the workstation worker since the job requires mouse use 75-80% of the time. Upon reviewing the video of Ms. Friedman at her workstation, it would be most beneficial to bring the mouse and keyboard to same level.

Recommendation: The Mead-Hatcher Articulating Keyboard and Mouse Drawer allows the employee the use the keyboard and mouse at the same level while bringing both items within a comfortable and neutral arm/hand position. This drawer was chosen for the following characteristics:

*Large 30" Wx12 ½" Dx3-5" drawer holds both keyboard and 8" Wx9 ½" D sure-tracking mouse pad with palm rest (pad, palm rest included)

*Adjustable 2 ¼” in height; angle adjusts up to 15° for a comfortable “reverse angle” position

*Ball-bearing slides extend drawer 10”; drawer locks in place for keying ease

Cost: $129.95

Keyboard: Due to the physical characteristics of the workstation employee, the optimal position is not feasible. While typing, the wrists should not be ulnar deviated which is the problem with the current keyboard. The employee must also forcefully press the keys for the key to register. This forceful exertion in combination with the awkward wrist deviation could increase the risk for CTDs.

Recommendation: The Microsoft Natural Keyboard forces the user to type with a natural wrist (non-deviated) wrist position. The split

V-shaped keyboard is recommended in this case because the employee is unable to fully bring the employee’s elbows toward the body. The Microsoft Natural Keyboard was chosen for the following characteristics:

*Prevents fatigue and helps typist work faster

*Split, sloped key arrangement, and built-in palm rest

*Soft key action action minimizes forceful exertion

Cost: $129.00

Footrest: With the current workstation setup, employee 1 must elevate the chair to an extremely high level in order to obtain a 90° bend in the arms while typing. This elevation forces her to have a knee bend that is 110°, which places an inordinate amount of pressure on the employee's thighs and lower back. With the addition of the keyboard/mouse tray, this height will be decreased by 3-4". This alteration still leaves about 2-3" of leg height to be elevated.

Recommendation: The simplest and most cost effective way to engineer this factor out is with a footrest. The other solution would be to lower the complete workstation which is labor intensive and limited by the adjustability of the workstation height.

The Rogers PC Foot Turtle was chosen for the following characteristics:

*Ergonomic footrests ease strain on legs, feet, and lower back

*Half-rounded bottom rotates freely for customized positioning

*Rounded design allows worker to move legs to increase dynamic movement and blood flow to legs, ankles and feet during seated position

Cost: $35.95

Document Holder: Neck strain at this workstation can be caused by numerous factors, one of those factors is from excessive neck twisting and downward rotation from document placement.

Recommendation: An easy and inexpensive solution to this probable cause to neck pain is a document holder. There are many expensive and elaborate holders on the market, but for this situation, an inexpensive, basic model will accommodate employee needs. The Fellows Copystand was chosen for the following characteristics:

*Attaches to the computer monitor for appropriate typing view height

*Flexible copy positioning and paper placement

*Right or left side use for employee preference

*Inexpensive solution to high potential loss problem

Cost $ 5.10

Monitor Risers: Employees of the current workstations are experiencing neck strain attributed to the inappropriate height of the monitors. Ergonomic standards recommend that the top of the monitor be at eye level or slightly lower. Employee 1's monitor is 5" below this recommended point. When the chair is lowered to the recommended height for the keyboard/mouse drawer, the monitor will need to be raised 3". The current position of the monitor forces her to look down into the monitor, exerting undue strain on her neck.

Recommendation: By placing two Curtis Monitor Riser Blocks under the monitor, it will raise the monitor the recommended 2 ½". These monitor risers were chosen for the following characteristics:

*Small, incremental increase

*Inexpensive solution

*High quality and multi-purposed

Cost: $11.32

Total Cost of Modifications: $790.00

Rationale to consider recommendations:

After thorough analysis, it becomes quite evident that the nature of employee 1's ailments can only grow worse. From a safety

standpoint, repetitive motion, cumulative trauma disorder (early symptoms), and posture are some risk factors. The real safety hazards present lie in the work station itself, and lend themselves more to a chronic-type of effect, rather than acute. It has the potential for a chronic injury because it tends to take time for most lower back and CTDs to develop, especially when dealing with office ergonomic issues. These recommendation from a safety standpoint attempt to engineer the hazards out of the environment, and those that couldn't be taken out, the recommendation was made to institute administrative controls to keep the hazard potential minimized. From a quality standpoint, these recommendations should be considered because the solutions for implementation take into account using only the highest quality products. The office supply distributors carry a wide array of ergonomic equipment that meets the technical data gathered in this study to best fit the job to the ailing employees.

Considering the nature and potential cost of the reported strains/sprains, it would make sound business logic to implement

these recommendations. As states previously, it was gathered from our analysis that various other employees as well as employee 1

have been suffering from minor pains to prolonged strains and discomforts in various parts of their bodies. This raises serious concerns from an employee health standpoint, because they need to be healthy on the job, with a high morale and sense of well being. This is needed in order to maximize their productive longevity at their employment.

The effectiveness of these recommendations will be evaluated based on various factors, but the main factor will be the return on investment. By the research into the cost of various types of injuries, including low back trauma, one can effectively stress the relative insignificance of the cost to implement the above recommendations, when compared to the cost of an average workman's compensation claim. Also, that cost does not take into account hidden or indirect costs. It will benefit the company financially to keep the employees healthy. Not having a worker compensation claim will eventually result in profit for the company, not a sunk cost, a kind of cost that comes out of profit and can never be regained.

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