ERGONOMICS DEMONSTRATION PROJECT

Analyzing Supervisors' Ability to Rate Caution Zone Jobs

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Department of LABOR AND INDUSTRIES

Analyzing the Ability of Supervisors to Rate Caution Zone Job Risk Factors

A survey of supervisors at four different worksites appears to show that supervisors are relatively accurate at rating Caution Zone jobs. Study participants were asked to rate 14 yes/no "Caution Zone" criteria for determining a Caution Zone Job according to the Washington State Ergonomics Rule. The supervisor ratings of each risk factor agreed with ergonomist observational work sampling of the jobs 81% of the time. Supervisors agreed with ergonomists 86% of the time as to whether to categorize the jobs as Caution Zone Jobs or not. Workers in the same jobs also agreed with ergonomist ratings of the Caution Zone risk factors in 75% of the cases. Over 93% of the people evaluated the Caution Zone risk factors in less than 30 minutes even though approximately two-thirds stated that they knew very little or nothing about the Ergonomics Rule.

Thirty-one supervisors and fifty-five workers at four different workplaces participated: an electronics manufacturing firm, a small grocery store chain, an insurance paperwork processing group, and a distribution warehouse. Two of the workplaces, Ken's Market and Fluke Corporation, participated in the study as part of ergonomics demonstration projects. The other two workplaces were distinct groups within the Department of Labor and Industries. Results for each of the workplaces were roughly the same in terms of percent of risk factors correctly classified. Supervisors, as a majority by group, correctly identified the "true" caution zone risk factor when present in all cases; however, at least one risk factor was incorrectly identified as being in the caution zone in each job. Thus, it appears that supervisors, though accurate, may tend to be conservative, at times incorrectly assuming caution zone classification of a risk factor where there is doubt. This project showed that supervisors and workers in both small and large companies can evaluate jobs for Caution Zone risk factors quickly and accurately for compliance with the Washington State Ergonomics Rule.

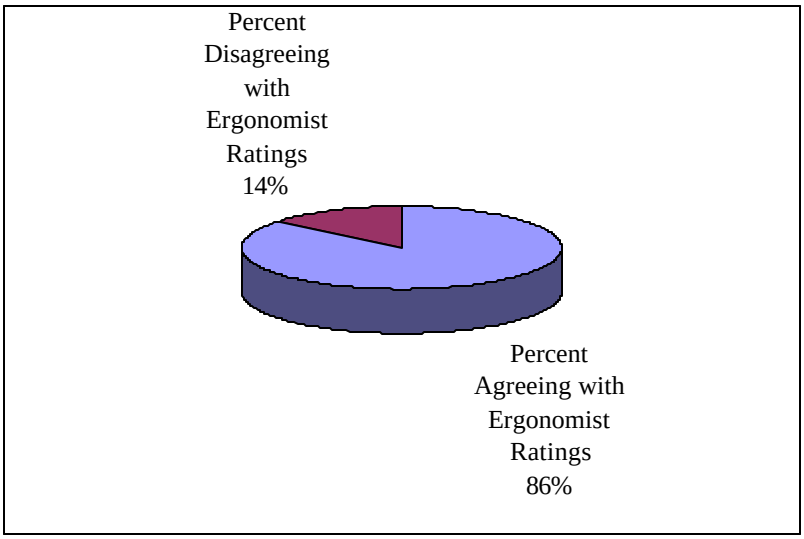

Figure 1. Supervisor agreement with ergonomist observations of Caution Zone risk factors in five different jobs.

Demonstration Project Results from the Fluke Corporation

Two high production assembly lines were observed by ergonomists at the Fluke Corporation, a manufacturer of electronic testing equipment. Ergonomists made work sampling observations of musculoskeletal disorder risk factors once a minute for at least two hours at four different tasks on each line. Workers typically rotate tasks, so an average of the four tasks was taken to obtain a risk factor level for each job.

Neck bending more than 2 hours per day and hand repetition more than 2 hours per day were observed as Caution Zone risk factors in these jobs. Hand repetition was the only Hazard Zone risk factor in one job, requiring feasible modifications. Job rotation between and within lines is practiced as part of the regular work activities, and two tasks had much higher hand repetition levels than the other. Because of this, changing the job rotation schedule easily reduced hand repetition below the Hazard Zone level. Workers in these Caution Zone jobs will also receive ergonomics awareness education.

This project showed that work sampling of repetitive work and jobs with different tasks is an effective method for evaluating work-related musculoskeletal disorder risk factor levels. An analysis checklist for work sampling was developed for the project, which is available to download from this site. The checklist is used by simply marking down risk factor observed once a minute for at least an hour for repetitive jobs. Every 60 seconds, a “mental snapshot” is taken of the posture and activity. This is used to check off observed risk factors. The percentage of the time risk factor are observed can then be extrapolated to an 8-hour day for Hazard Zone analysis.

Table 1. Washington Ergonomics Rule Caution Zone Risk Factors and Work Sampling Results for T5 and 80 Series Assembly Lines at Fluke Corporation (Bold Indicates Possible Caution Zone Level Risk Factor)

Caution Zone Risk Factors

Awkward Posture	**T5**	**80 Series**
(1) Working with the hand(s) above the head, or the elbow(s) above the shoulder, more than 2 hours total per day	Not Observed	< .5 hour
(2) Working with the neck or back bent more than 30 degrees (without support and without the ability to vary posture) more than 2 hours total per day	**~ 4 hours**	~1 hour
(3) Squatting more than 2 hours total per day	Not Observed	Not Observed
(4) Kneeling more than 2 hours total per day	Not Observed	Not Observed
High Hand Force		
(5) Pinching an unsupported object(s) weighing 2 or more pounds per hand, or pinching with a force of 4 or more pounds per hand, more than 2 hours total per day (comparable to pinching half a ream of paper)	< .5 hour	~ 1 hour
(6) Gripping an unsupported object(s) weighing 10 or more pounds per hand, or gripping with a force of 10 or more pounds per hand, more than 2 hours total per day (comparable to clamping light duty automotive jumper cables onto a battery)	Not Observed	Not Observed
Highly Repetitive Motion		
(7) Repeating the same motion with the neck, shoulders, elbows, wrists, or hands (excluding keying activities) with little or no variation every few seconds more than 2 hours total per day	**~ 6 hours**	**~ 5 hours**
(8) Performing intensive keying more than 4 hours total per day	< .5 hour	< .5 hour
Repeated Impact		
(9) Using the hand (heel/base of palm) or knee as a hammer more than 10 times per hour more than 2 hours total per day	Not Observed	< .5 hour
Heavy, Frequent or Awkward Lifting		
(10) Lifting objects weighing more than 75 pounds once per day or more than 55 pounds more than 10 times per day	Not Observed	Not Observed
(11) Lifting objects weighing more than 10 pounds if done more than twice per minute more than 2 hours total per day	Not Observed	Not Observed
(12) Lifting objects weighing more than 25 pounds above the shoulders, below the knees or at arms length more than 25 times per day	Not Observed	Not Observed
Moderate to High Hand-Arm Vibration		
(13) Using impact wrenches, carpet strippers, chain saws, percussive tools (jack hammers, scalers, riveting or chipping hammers) or other hand tools that typically have high vibration levels more than 30 minutes total per day	Not Observed	Not Observed
(14) Using grinders, sanders, jig saws or other hand tools that typically have moderate vibration levels more than 2 hours total per day	Not Observed	Not Observed

Demonstration Project Results from Ken's Market

Workers performing stocking and checking were observed by ergonomists at Ken's Market, a small grocery store chain. Two different workers were observed performing each of the jobs for at least an hour each. Ergonomists recorded work sampling observations of musculoskeletal disorder risk factors once a minute to obtain risk factor level estimates.

Neck bending more than 2 hours per day during stocking and hand repetition more than 2 hours per day during checking were found to be Caution Zone risk factors for these jobs. These risk factor levels were very close to the Caution Zone level and no risk factors exceeded the Hazard Zone level for these checking or stocking at these stores. The workers in these jobs will receive ergonomics awareness education. No modification of these jobs is required by the Washington State Ergonomics Rule.

This project showed that work sampling is an effective method for evaluating musculoskeletal disorder risk factor levels of grocery store jobs. An analysis checklist for work sampling was developed for the project, which is available to download from this site. The checklist is used by simply marking down risk factor observed once a minute for at least an hour for repetitive jobs. Every 60 seconds, a "mental snapshot" is taken of the posture and activity. This is used to check off observed risk factors. The percentage of the time risk factor are observed can then be extrapolated to an 8-hour day for Hazard Zone analysis.

Table 2. Washington Ergonomics Rule Caution Zone Risk Factors and Work Sampling Results for Checking and Stocking (Bold Indicates Possible Caution Zone Level Risk Factor)

Caution Zone Risk Factors

Awkward Posture	**Checking**	**Stocking**
(1) Working with the hand(s) above the head, or the elbow(s) above the shoulder, more than 2 hours total per day	< .5 hour	~1 hour
(2) Working with the neck or back bent more than 30 degrees (without support and without the ability to vary posture) more than 2 hours total per day	~ 1 hour	**~2 hours**
(3) Squatting more than 2 hours total per day	< .5 hour	~.75 hour
(4) Kneeling more than 2 hours total per day	< .5 hour	~.5 hour
High Hand Force		
(5) Pinching an unsupported object(s) weighing 2 or more pounds per hand, or pinching with a force of 4 or more pounds per hand, more than 2 hours total per day (comparable to pinching half a ream of paper)	< .5 hour	~ .5 hour
(6) Gripping an unsupported object(s) weighing 10 or more pounds per hand, or gripping with a force of 10 or more pounds per hand, more than 2 hours total per day (comparable to clamping light duty automotive jumper cables onto a battery)	< .5 hour	~ .5 hour
Highly Repetitive Motion		
(7) Repeating the same motion with the neck, shoulders, elbows, wrists, or hands (excluding keying activities) with little or no variation every few seconds more than 2 hours total per day	**~2 hours**	< .5 hour
(8) Performing intensive keying more than 4 hours total per day	< .5 hour	< .5 hour
Repeated Impact		
(9) Using the hand (heel/base of palm) or knee as a hammer more than 10 times per hour more than 2 hours total per day	< .5 hour	< .5 hour
Heavy, Frequent or Awkward Lifting		
(10) Lifting objects weighing more than 75 pounds once per day or more than 55 pounds more than 10 times per day	Not Present	Not Present
(11) Lifting objects weighing more than 10 pounds if done more than twice per minute more than 2 hours total per day	Not Present	Not Present
(12) Lifting objects weighing more than 25 pounds above the shoulders, below the knees or at arms length more than 25 times per day	Not Present	Not Present
Moderate to High Hand-Arm Vibration		
(13) Using impact wrenches, carpet strippers, chain saws, percussive tools (jack hammers, scalers, riveting or chipping hammers) or other hand tools that typically have high vibration levels more than 30 minutes total per day	Not Present	Not Present
(14) Using grinders, sanders, jig saws or other hand tools that typically have moderate vibration levels more than 2 hours total per day	Not Present	Not Present

WORK SAMPLING CHECKLIST

Washington State Department of Labor and Industries:
November 2001

Location _____ Participant Number _____ Date_____
Job _____ Page_____
Task _____ Time start _____ Time stop _____
Observer(s)_____
Objects in CZ and/or HZ: Weight/force >2# _____
>4# _____
>10#_____

Time																								
	1		2		3		4		5		6		7		8		9		10		11		12	
Posture	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Hand(s) above head																								
Elbow(s) above shoulder																								
Wrists >30° flexion =1 >45° extension =2 >30° ulnar deviation=3																								
Neck bent (>30°=1; >45°=2)																								
Back bent (>30°=1; >45°=2)																								
Squatting																								
Kneeling																								
Force	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Pinch > 2# object																								
Pinch > 4# force																								
Grip >10# object or force																								
Repetition	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Shoulders																								
Elbows																								
Wrist/hands																								
Intensive keying																								
Neck																								
Impact	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Hand as hammer																								
Knee as hammer																								
Lifting																								
Lift wt.#: 10-35 = 1 36-55 = 2 56-70 = 3 71-90 = 4 >90 = 5 Lifting: Near = 1 Mid = 2 Far = 3																								
Lifting: below knee =1 thigh to chest =2 above shoulder =3																								
Vibration																								
(do vib tool =1;mod =2;hi=3)																								

Checklist Instructions

Although not required by the Washington State Ergonomics Rule, this checklist, which was developed as part of a demonstration project with employers, can be used to assist in the identification and analysis of Caution Zone jobs using representative work sampling.

The following information will assist employers and others in understanding the checklist and the best ways to use it:

This checklist can be used to perform work sampling for determination of risk factor levels for Hazard Zone analysis. This is one widely used approach often applied to more unstructured work environments such as construction and agriculture. This is only one of many possible approaches for these and other work environments. This checklist can be used or modified for use in two ways.

1) The checklist was used in demonstration projects as a work sampling checklist. This means that once every 60 seconds a "sample" of the job is taken. An observer watches a worker performing the task or job of interest. Every 60 seconds a mental snapshot is taken of the position and activity of the worker at that specific instant in time. This "snapshot" is then compared to the checklist and appropriate boxes for all risk factors are marked. Generally, at least 60 samples should be taken. The number of samples with a risk factor observed are then divided by the total number of samples for each studied risk factor. The resulting number is then multiplied by the number of hours worked to obtain the time during the day that the risk factor is present. This time in hours can then be compared to Hazard Zone levels for each risk factor contained in Appendix B of the Ergonomics Rule. Samples should be taken during times that represent the work activity. If the work changes for the studies task during the day, between workers, or on different days, then care should be taken to record samples from these instances as well.

2 The checklist can be also be used to perform a time study. This approach is better for more structured work environments or repetitive work such as an assembly line, but can also be applied to environments such as construction and agriculture if preferred by the analyst. In this approach, the analyst observes the job of interest for one risk factor at a time. Each Caution Zone risk factor is observed for at least 20 sampling periods during the job observation. The analyst observes the job for 60 seconds during each sample and calculates the number of seconds that the studied risk factor was present during that minute. This number is then written in the space above the sample number. This is repeated 20 times for the risk factor. The total number of seconds the risk factor was observed across samples is added together. This is divided by 1200 (60 sec. x 20 samples). The resulting number is then multiplied by the number of hours worked to obtain the time during the day that the risk factor is present. This time in hours can then be compared to Hazard Zone levels for each risk factor contained in Appendix B of the Ergonomics Rule. The process is then repeated for each Caution Zone risk

factor present in the job. As with work sampling, care should be taken to assure that the period of job observation accurately represents the work being done for that job on most days.

The following is an example of the time study method application of the checklist:

Job Studied: Electronic Cabinet Assembly

Risk Factor: Hand Repetition (Known Caution Zone Risk Factor)

Goal: Evaluate Hand Repetition to Determine Whether the Duration of the Risk Factor Exceeds the Hazard Zone Level of 6 Hours per Day

Results: 20 One-minute Observations Were Taken for the Risk Factor of a Worker Performing the Usual Task

1) The Following Shows How Many Seconds the Risk Factor was Observed for Each of the 20 60-Second Samples:

20/60, 35/60, 40/60, 32/60, 35/60, 42/60, 31/60, 31/60, 35/60, 45/60, 46/60, 44/60, 40/60, 39/60, 40/60, 38/60, 30/60, 35/60, 36/60, 39/60

2) If You Add All the Number on Top and All the Numbers on the Bottom Together, You Get:

697/1200 = .58

3) Multiplying This Number by the Hours Doing This Job per Day Gives:

.58 x 8 Hours = 4.64 Hours Hand Repetition is Present

4.64 Hours is Less Than Hazard Zone Level of 6 Hours – Hand Repetition is not a Hazard Zone Risk Factor for This Job