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# Ergonomics Evaluation Report on a Trimmer Operator's Job

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## **Executive Summary**

Musculoskeletal injuries are one of the major occupational health problems in the sawmill industry according to a recent study published by the Washington State Department of Labor and Industries. Musculoskeletal injuries in the sawmill industry have been a focus of prevention activities by the State. A large sawmill's concern about musculoskeletal injuries in the trimmer job initiated this study. The aim of this study was to identify and quantify risk factors in this job that may contribute to the development of musculoskeletal injuries and investigate possible contributory causes in the production process with the aim for prevention. A better understanding of the relationship between the job contents, physical workload (risk factors) and musculoskeletal injuries is the basis for developing effective ergonomic intervention measures. A second aim of the study was to help the ergonomics committee in this sawmill with their ergonomic intervention activities. Finally, this study was conducted to test some physical exposure measurement and analysis tools, and modify the test protocols for future large-scale studies in this industry. Results obtained by brief observational physical assessment methods were compared with detailed quantification methods to provide the scientific basis for the ergonomics committee to use the simpler method in future evaluations. Two trimmer operators participated in this study and each was measured for two days when two different products were processed. Detailed observational methods were used to quantify the task distribution, repetitiveness of hand exertion and work postures. A scoring system (RULA) was used to estimate the risk levels of the work postures. Observed work postures are categorized by four action levels (1-acceptable, 2-further investigation needed, 3-investigation and changes needed soon, and 4-investigation and changes required immediately). Electromyographic (EMG) and electrogoniometric measurements (labeled as direct measurement) were employed to quantify the muscle loads on four muscles in the neck/shoulder and forearm regions, and postural loads of the wrist and forearm. Additionally a brief observational method was used to identify job risk factors during performing the different tasks of the job.

Results show that the trimmer operators spend most of their time in the task of monitoring and positioning boards (76% of the time). Ergonomic intervention efforts should be concentrated on reducing risk factors involved in this task. Dealing with upset conditions, when extreme physical workload conditions may occur, takes about 10% of the time. On average, it takes about 15 seconds to resolve the problems of upset conditions.

Major risk factors in this job include

- high repetitive hand exertion (about 21 times per minute or cycle time of 2.9 seconds),
- awkward wrist postures (27% of time in moderate and severe wrist extensions, 30% in severe ulnar deviation and 18% in extreme forearm pronation) and
- high hand force exertion (up to 40 lbs. of manual lifting, median muscle load level of the forearm flexor and extensor of 2.7% and 7.1% of the worker's Maximal Voluntary Contraction capacity - usually known as %MVC).
- High static shoulder muscle load (3.23%MVC) was observed in one of the operators.

Overall, most of the work postures (more than 85%) were considered involving some sort of postural risks (RULA level 2 and 3) and some further investigations and changes may be needed,

though less than 5% of the work postures were considered extremely poor and require immediate investigation and changes (RULA level 4).

In spite of similar production and job requirements, different operators may use different work techniques in performing the tasks. This resulted in different physical workload such as frequency of hand exertion (3.2 vs. 2.6 times/min), work postures (e.g. 3.8% of time in wrist extension greater than 45° vs. 54% of time) and muscle loads (e.g. static shoulder muscle load at 3.23%MVC vs. 0.95%MVC). Handling boards of different species also resulted in different physical workload on the operators. For instance, when handling smaller, lighter hemlock boards compared to fir, the operators may primarily use their hand/arm motions to accomplish the task compared to involving the trunk muscles when handling bigger and heavier objects (fir boards). The results suggest that workers need to be provided with proper work techniques with relation to the specific products in order to reduce the risks of causing musculoskeletal disorders.

Three approaches are needed to address these risks. First there needs to be improved machine designs (unscrambler and the board kicking mechanism) to reduce high hand/wrist loads. Second, improved technique training is required for newer operators. Third, improved teamwork is crucial in the ergonomic intervention process. Informing upstream operators about the consequences of the way they cut logs on the work of the trimmer station may help them to improve the quality of cuts, thus reduce the physical demands on the trimmer operators.

The brief observational method could identify certain risk factors. It can be used by ergonomics committees to make ergonomic intervention decisions. However, it may not always provide precise and specific quantitative exposure information. Detailed observations and direct measurement could provide accurate and specific exposure data, but they are time consuming and require large amounts of resources in data collection, analysis and interpretation. To increase the efficiency of data collection in the field ergonomic research, calibration procedures for the direct measurements need to be improved. Research data are needed to determine the necessary sampling time in order to obtain reliable hand repetitive exertion and work posture results when using the detailed observational method.

