

CHAIN SAW TROUSERS AND PROTECTION STANDARDS  
EFFECT ON METABOLIC WORK, HEAT PRODUCTION, COMFORT AND SAFETY

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INTRODUCTION

A survey carried out by the Health and Safety Executive (HSE - Edinburgh) concluded that an analysis of 119 chain saw injuries revealed the need for greater protection to the face, head, neck, hands and arms and, in particular, for all-round protection of the legs. The evidence for increased leg protection indicated that **46%** of injuries occurred on the legs, with 11% of these on the upper leg back and 15% on the lower leg back. Although the severity of the individual accidents was not reported, 93% needed hospital treatment with the individuals having an average of **28** days absence from work. By comparison details of Forestry Commission (FC) injuries since 1980 show a somewhat lower proportion of injuries to the backs of the legs (upper = **4%**, lower = **14%**). Neither the HSE nor the FC data demonstrate the comparative potential risk to the fronts **and** backs of the legs, because the injuries have been reduced by the provision of protection, more often to the fronts than the backs. German data, however, in respect to chain saw accidents in forestry work give details of all cuts - i.e. cuts to the protective material as well as to the legs themselves. On the basis of these data, where no protection is provided, 95% of the risk of chain saw injury to the legs of forest workers is to the fronts and only 5% to the backs. It would be logical therefore to take into consideration the distribution of the risk when deciding about the distribution of protection to be provided.

Cuts (11.4%) are certainly not the most frequent injury sustained in forestry harvesting work. The sprains/strains (**51.8%**), bruises (14.0%), dislocations (0.9%) and fractures (7.9%) which make up the majority have two main causes - lifting and falling. Falls are unavoidable particularly on conifer clear fell sites with the inevitable mass of debris hampering movement; but they need to be reduced to the unavoidable minimum. Anything which further hampers movement has to be thoroughly justified. Consequently the Forestry Commission commissioned the Ergonomics Unit at the Polytechnic of Wales to investigate and compare the physiological, subjective and safety effects on forest workers of wearing chain saw trousers with full protection all round the legs up to the waist at the front and to the crotch at the back, and of wearing the current FC trousers with protection restricted to the front and extending up to a level 10cm. above the crotch.

METHOD

Analysis of chain saw users identified three areas of work - felling and shedding trees and movement of the whole body around the work site area. The latter exercise, being more crucial to the effect of wearing padded trousers, was subsequently adopted for simulation of work in the laboratory. In the investigation 6 FC workers walked over a stepped and spring-gated apparatus with simulated ground conditions of a harvesting site for 20 minutes. Heart rate, sweat rate, aural, mean skin, thigh and calf temperatures were measured before (10 mins), during (20 mins) and after each experiment together with the number of times they struck the gates. The wearers' subjective opinions were recorded using a questionnaire. All the first three variables were also combined into a "physiological stress

value" (Zakay et al, 1982) and experiments were undertaken in a climatic enclosure ( $20^{\circ} \pm 1^{\circ}$ ;  $55\% \pm 5\%$  Relative Humidity) (Cuff et al, 1983).

## RESULTS

Heart rate, aural, mean skin, calf and thigh temperature's rose steadily as exercise commenced, reflecting the gradual elevation in thermal strain. There was a noticeable elevation in thigh, calf and hence mean skin temperature of subjects wearing the semi-padded and fully-padded trousers throughout the experiment. The physiological stress value, showed that the wearing of fully-padded trousers carried a significant increase in strain compared with both normal and semi-padded trousers.

Table 1  
Statistical Comparison between the Physiologic 1st Value  
whilst wearing the Variable Trouser Condition

Normal v Semi-padded	Normal v Fully-padded	Semi-padded v Fully-padded
t = 1.0104 p = -	t = 2.9360 p = <0.05	t = 3.1340 p = <0.05
n = 8	n = 8	n = 6

## CONCLUSIONS

The investigations produced clear physiological and subjective evidence that the wearing of fully-padded trousers would be detrimental to the health, safety and performance responses of forest workers. Introduction of protection to the backs of the legs greatly increases the risk of trips and falls and does not justify the reduced risk of cuts by only 5%. As a result of the work, adaption of fully-padded trousers by the British Standards Institution was subsequently not imposed. Implications for European Standards will follow the BSI decision.

## REFERENCES

1. Welstead D., Summary of Chain saw Injury Survey. Forestry and Arboricultural Group: Health and Safety Executive, Edinburgh 1989.
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3. Cuff D.J., Taylor L.G. and Thomas N.T., Outdoor Protection Project (I), Health and Safety Executive, Report RPG 1789, 1983.