Ergonomics at Hoffman Engineering

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1. Introduction

Hoffman Engineering, a large private semi-light engineering company in WA was opened in 1969 by John and Eric Hoffman. The company specialises in producing and reconstructing mining and fence equipment and in the design and production of prototypes to specifications. In particular, the company produces high quality gears. Located in Bayswater, the company occupies three acres of land, with a staff of 200 employees and a turnover of twenty million dollars annually.

2. Physical Environment

The company operates within four large galvanised warehouses. Insulation is provided in the ceilings, to reduce reflection of summer heat and the walls possess many large ventilation holes to allow free movement of air. Transparent plastic panels are used for windows. Nevertheless, the working environment is very hot in summer, exceeding the recommended effective heat limit, and approaching 40 degrees C. The environment is cool and damp in winter. A case hardening plant generates a hot environment at all times. During winter months, a cold environment reduces finger dexterity for fine manipulation of controls while in summer, heat reduces vigilance and leads to the need for frequent rest breaks.

The high intensity lighting is dimmed during the day creating a somewhat gloomy atmosphere, which is nevertheless, bright enough to make the required fine measurements. Improved daytime lighting may speed up productivity.

Increased productivity of the workers would be obtained through air-conditioning. If this project was undertaken, the fine tolerance shop in which gears are manufactured should be airconditioned first. The critical measurements undertaken in this shop would be those most affected by extremes in environmental conditions. Additional ventilation would improve environmental conditions in the case hardening shop.

Growing use of temperature sensitive computerised equipment may be the real reason behind the consideration of airconditioning. The benefits of this change must be weighed against the three quarters of a million dollar price tag.

The buildings have a high noise level in excess of 90 DBa due to the operation of many machines and the cutting of metals. This noise may be extremely loud and high pitched in places. Such noise may interfere with productivity by increasing the possibility of errors of omission. Deafness also occurs over the long term, if hearing protection devices are not worn. Use of sound deadening materials in the building would reduce the noise level and facilitate communications.

Cleanliness of work spaces is emphasised. Excess oil and scrap metal fragments are removed daily with a half hour cleaning period. One and a half hours is devoted to cleaning on Fridays. Downtime is used for cleaning. Although floors were clear of debris, grease and oil adheres to the cement and workers were generally dirty and oil smeared. A clean workplace improves safety, the morale of workers and the pride that they take in their work. It also improves productivity by reducing the possibilities of misplaced tools and parts.

3. Safety

The working environment is hazardous for a variety of reasons. Heavy weights are being lifted and moved. Power machinery with moving parts and sharp cutting instruments are being operated, which generate sharp metal fragments. Gloves to protect the hands are not always worn, perhaps because of reduced finger dexterity. Extremes in heat from welding in the fabrication shop and case hardening and heat treatment may cause heat stress and physical burns. Poisons such as sodium cyanide are used for case hardening.

Safety is emphasised by training posters and by training apprentices to work safely. A pay demerit system tied to following safety rules was tried and abandoned due to union pressure. Use of training films, talks, simulations and other techniques in an employee inservice programme and tying safety in with the bonus pay system is recommended as means to improve safety.

Steel toed work boots and work overalls are compulsory. Safety glasses and ear muffs are not enforced rigidly and workers are expected to use their common sense and judgment in safety matters. Many

workers were seen without safety glasses and ear muffs in noisy hazardous conditions. Loud noise will lead to hearing loss over time. Sharp metal fragments may damage eyesight.

Approximately three accidents of a serious nature occur annually. A first aid station and first aid kits are available.

Yellow lines mark the floors to designate clear areas free from storage of machine parts for movement of fork lifts loaded with pallets. Maintenance of these thoroughfares is as much a productivity as a safety factor. Congestion of thoroughfares is a problem with inadequate room for fork lifts to turn around. Parts infringing on these thoroughfares must be marked with warning devices. Thoroughfares were maintained very well.

Use of pallets and fork lifts is common. Provision of large overhead cranes in all parts of the buildings reduces the need for any lifting of heavy objects. Consequently, there are few back injuries reported. Heavy parts are stacked on wooden shelves over three meters high. This practice appeared hazardous because of danger of shelves collapsing or heavy objects rolling onto pedestrian workers.

4. Training

Twenty apprentices are employed annually and these are rotated every three months to give them experience on all the machines. The four year apprenticeship qualifies the worker in a range of occupations including fitting, tool making, boiler maker and machinist. Apprentices may stay with the company following completion of the apprenticeship.

This programme is seen as a good source of skilled labour loyal to the company. Company paternalism and interest in its employees' welfare has been shown to improve productivity in Japan.

5. Management

Five to six workers are under a leading hand. A supervisor controls five to six leading hands. Three engineers are employed. The management structure does not seem top heavy, and reduces costs of highly salaried managers.

Workers have clearly defined tasks with a regular throughput of parts to be processed. Consequently, everyone seemed busy and the need for supervision is minimised. Emphasis should be and appears to be on inspection and quality control. Bottlenecks in assembly line production are examined by the supervisors and may be resolved by shifting the worker.

6. Divisions of the Company

Machines are grouped by sequence in the production line process to reduce movement of articles from one machine to the next. The exception to the rule was the heavy engineering division which grouped by function; all the very large machines together. Lifts in this area handle 5,000 kilogramme.

Areas include stores, dispatch, inspection, milling, drilling, gear cutting, heat treatment, fabrication, fitting, turning and CNC. There is also accountants (receivable and payable), estimates, payroll officer, shop control and management. Extensive use is made of subcontractors and foundries.

Pallets on fork lifts and overhead cranes move parts from one adjacent machine to the next, minimising transit time and distance. Tools are checked out from a central stores, enabling control of inventory. Machinists provide their own basic tools and receive a tool allowance.

7. Computerisation Issues

The oldest machine dates back to 1897. Older lathes possess an array of calibrated wheels and knobs which require highly trained machinists to operate.

An increasing number of machines are fully computerised and may be operated by lesser trained, second

class machinists. One programmer is employed to set up these machines. Consequently, there may be a reduced demand for skilled machinists.

The company spokesperson felt that the nature of one off jobs handled by the company continued to require expert machinists. The time involved programming the computerised machines for single jobs was seen to be uneconomical. Consequently, computerisation was not seen as a threat to experienced machinists.

This rationale seems to be a public relations exercise, since modern computerised equipment programmes itself based on a single demonstration of an operation. For repetitive jobs, computerisation removes the tedium and permits workers to undertake other work.

Multi-skilling is recommended to reduce redundancy caused by the continued computerisation programme.

8. Shift Work and Overtime

The plant operates on two ten hour shifts daily six days weekly. These are extended to twelve hour shifts if work is pressing. Although a 38 hour work week is normal, substantial overtime is available on a volunteer basis and work may be extended to 70 or 80 hours annually. Seventy five percent of employees work overtime and overtime availability is tied to a bonus pay scheme offered by the company. Workers must take a ten hour break between shifts.

Overtime, shift work and the long work day must affect the quality of work completed by the employees. Increasing the pool of available trained workers would reduce this problem. The option chosen by the company is a bonus incentive scheme of up to $100. weekly, provided for high productivity and low wastage and error rates. An additional $50. is provided weekly for being at work punctually without absenteeism. Use of positive reinforcement is highly successful in ensuring compliance to regulations.

9. Conclusion

It seems incredible that people choose to work in dirty, noise potentially dangerous and hot or cold environments. However a high rate of pay causes 10 to 20 people to apply daily for work. Mean length of stay for skilled staff is five years. The turnover for unskilled staff and trades assistants is 175 people per year.

The high rates of pay combined with freedom to get on with the job has created good worker morale and reduced skilled staff turnover. Consequently, Hoffman's has the reputation of being a desirable place to work.

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