ERGONOMICS DEMONSTRATION PROJECT

PABCO

Roofing products manufacturer

December, 2002

Department of LABOR AND INDUSTRIES

PABCO Roofing products

Ergonomics demonstration project report

Introduction

In August 2002, PABCO, a Tacoma roofing products manufacturer, and the Department of Labor and Industries (L&I) of the State of Washington began an ergonomics demonstration project. The purpose of this project is to share with the business community several applications of ergonomics principles and their benefits to the employees' health and safety at work.

About PABCO Roofing Products

PABCO Roofing is a manufacturing plant in Tacoma that supplies asphalt shingle products to the western part of the United States.

PABCO invests significant time, money and effort into training its employees to ensure their safety and well-being. In the period 1992 – 2001, of all the injuries and illnesses registered, seven back injuries were reported; only one of which required time loss (4 days). Only one of the back injuries was related to manual material handling tasks. In this ten year period, the company had over 2.5 million worker-hours.The plant has a full time safety and health manager, responsible for implementing and maintaining safe working conditions, employee education and training related to all the potential hazards present in the process.

Because of the preventive approach referred to above, PABCO started implementing ergonomics before the ergonomics rule was enacted. Manufacturing asphalt shingles, as described in the next sections of this report, includes a wide variety of jobs, especially materials handling. Many of the jobs in the process, if done manually, would require workers to lift heavy loads regularly.

This report describes ergonomics applications to materials handling to reduce lifting, housekeeping to prevent awkward postures, and job specific training techniques to assess the appropriate use of all the equipment and procedures. The application of the ergonomics principles has helped in reducing risk factors such as lifting heavy materials, lifting frequently, lifting in awkward postures, back bending, forceful gripping and highly repetitive movements of the upper extremity.

This report is an example of the application of ergonomics principles, their costs and benefits in keeping a healthier workplace for the employees. As well, some benefits in productivity and quality could also be noticed.

Table 1. Summary of ergonomics improvements at PABCO

Activity	Risk factor	Ergonomics @ work*
Handling of fiberglass rolls onto the machine	Pushing (not covered by the WA State rule)	Forklift
Sweeping the floor from loose granular components of the shingles	-Highly repetitive motions combined with forceful gripping -Back bent > 30 degrees	Automatic sweeper
Palletizing bundles of shingles	Lifting frequently > 10 pounds, more than 4 hours a day	Automated palletizer
Loading wooden pallets to the palletizing machine	Frequent lifting > 50 pounds	Forklift brings the stack of pallets to the machine dispenser.
Shipping customers' orders onto trucks	Heavy lifting > 90 pounds	Forklift used to unload palletizing machine and transport and load onto trucks
Shipping customers' mixed product orders	Frequent lifting > 10 pounds, less than 2 hours a day	Done manually. Bringing the forklift forks to operators waist height, so most of the bundles can be slid across
Other activities: House keeping. The manufacturing process generates lots of particulate material on the horizontal surfaces in the plant	Falls; awkward postures; unnecessary motions; air pollutants.	Systematic housekeeping and automated sweeper keeps the plant in clean condition

***Ergonomics @ work.** Applications of ergonomics in real work settings. Term used by the L&I ergonomics team.

Making asphalt shingles at PABCO

In this plant, the manufacturing of asphalt shingles is a fairly well automated process, with little direct worker intervention in the process. Employees' main duties are the operation of the equipment and supervision of its function, through control panels, video displays and direct observation along the manufacturing process.

An asphalt shingle has the following ingredients:

- Fiberglass mat
- Petroleum Asphalt
- Ground limestone
- Colored granules
- Slag granules
- Headlap granules / sand

1. Installation of fiberglass rolls onto the mechanical dispenser in the machine.

These very heavy rolls are transported and placed in position using mechanical equipment. The worker adjusts the position of the rolls on the floor to insert the metal shaft. There is some muscular effort required.

On the floor there are small metal bumps to prevent the rolls from rolling back and injuring the worker.

Other risk factors eliminated.

- Pushing; pulling
- Being struck by a rolling fiberglass felt roll

2. Liquid asphalt and granules are added to the fiberglass core. The workers supervise the process and adjust the machine through several controls and displays panels. There is some exposure to heat and fumes (asphalt fume testing has shown exposures below the PEL). Because the excess granules fall to the floor, there is a constant need to clear sections of the machine and floor by shoveling and sweeping.
An automatic sweeper is used to continuously clean the granules that are produced in the addition of the granules to the fiberglass felt. Previously the floor was swept manually, with the risk of back bending and high hand force.

Risk factors eliminated:
- Highly repetitive motions > 2 hours a day combined with forceful gripping;
- Back bending > 30°

Other risk factors present
- Heat, humidity

3. The shingles band is cooled-off and cut down to commercial length (39 3/8 - 40 inches). The workers supervise the process and adjust the machine through several controls and displays panels. The machine takes care of the trimming and moving the shingle to the next process, so there is no employees exposure to repetitive forceful gripping or frequent lifting.

Risk factors eliminated:
- Highly repetitive motions > 2 hours a day combined with forceful pinching and gripping;
- Back bending > 30°
- Heavy and frequent lifting

Other risk factors present
- Heat, humidity

4. <u>The shingles are made into bundles and shrink - wrapped.</u> Depending on the product, bundles weigh between 65 to 80 pounds. The workers supervise the process and adjust the machine through several controls and display panels. Because the stacking and wrapping of the shingles is automated, the employees are not exposed to repetitive forceful pinching and frequent and awkward lifting.

Eventually, when there are quality control concerns, workers need to manually remove the bundles from the conveyor. This results in some awkward lifting but this is not a regular and foreseable exposure as described in the ergonomics rule.

Risk factors eliminated:

- Highly repetitive motions > 2 hours a day combined with forceful gripping;
- Frequent lifting > 10 lbs more than 4 hours a day

Other risk factors present

- Occasional frequent and heavy lifting

Inspection / Quality Control

Bundles feeding into shrink-wrap machine

Shrink-wrapped bundles

5. Automated palletizing of the bundles of shingles. Depending on the product, bundles weigh between 65 to 79.74 pounds. The workers supervise the process and adjust the machine through several controls and display panels. In the two visits to the plant by L&I ergonomists the absence of workers in this part of the process was noticed. There are video monitors in specific locations to visually and electronically supervise the automated processes.

In the past, the employees palletized the bundles, which would have placed all the tasks in this process over the hazard level for heavy lifting (> 90 pounds), since it was a common practice to lift two bundles at a time. Frequent and awkward lifting (above the shoulders, below the knees) was most likely to be present in the process.

The automated palletizer is a major engineering implementation that actually eliminates lifting activities and the hazard for lower back injuries in this process.

Risk factors eliminated:

- Highly repetitive motions > 4 hours a day combined with forceful gripping;
- Lifting heavy > 90 lbs
- Lifting awkward > 25 lbs
- Lifting frequent > 10 lbs

6. Shipping palletized loads of shingle bundles. Once the palletizer has completed a pallet, it is placed onto a conveyor that ends in a docking station.

A forklift takes the pallet from the docking station and puts the pallets in a "train" of two to three cars.

The "train" of cars is then shipped onto truck trailers or stored in a shipping yard.

The three processes described above do not require workers to manually handle the bundles. Therefore heavy, frequent and awkward lifting, as well as pishing and pulling are avoided.

Risk factors eliminated:
- Lifting heavy > 90 lbs
- Lifting awkward > 25 lbs
- Lifting frequent > 10 lbs

Other risk factors eliminated:
- Pushing / pulling

7. Mixed product orders. Frequently, some customers require a mix of products in a single order.

Making special orders requires the forklift operator to manually handle the bundles and break a full pallet of one type of product.

The range of weights to be lifted is between 65 pounds to 80 pounds.

Making special orders will put the workers at risk of a back injury by frequently lifting more than 55 pounds, more than 10 times a day. This is not an everyday event for loaders.

PABCO and its employees, with the help of L&I ergonomists, are looking for better ways to complete this activity when it is necessary.

In the mean time, the company has created a policy and trained its employees in handling the bundles at waist level. Thus, back bending, or lifting above shoulder level has been addressed. Back twisting remains to be addressed

Whenever a special order is needed, the forklift operator has to bring the forks up to waist level, as shown in this series of photos.

Risk factors eliminated:

- Highly repetitive motions > 2 hours a day combined with forceful gripping;
- Lifting frequent > 10 lbs
- Lifting awkward > 25 lbs

Existing Ergonomics-Related Accomplishments

(Summary)

In-Place Accomplishment	**Ergo Rule Risk Factor Reduced or Eliminated**
Fork lifts: moving bundles, full/partial pallets Other mechanical equipment: moving fiberglass rolls, sand/granule bags, empty pallets, etc.	Heavy lifting, awkward lifting
Conveyors (powered and gravity) for moving bundles along the production line	Heavy lifting, awkward lifting, frequent lifting
Automatic palletizer	Heavy lifting, awkward lifting, frequent lifting
Mechanical Sweeper: for granules from the coating process	Highly repetitive motion, back bending
Hand truck (for moving quality control tested loose bundles)	Heavy lifting, awkward lifting
Good housekeeping / clear aisle ways (permitting use of mechanical lifting devices such as forklifts, hand trucks)	Heavy lifting, awkward lifting
Cross training of workers	Lifting, highly repetitive motions

Ergonomics Rule possible concerns. Further analysis/data required

Operation/Task	Ergo Rule Risk Factor Of Possible Concern	Possible Risk Reduction Option Ideas
Loader (partial orders) Transfer of bundles from full or partial pallet to customer pallet	Heavy, Awkward Lifting (fork lift forks --> pallet)	* To be determined • Mechanical lifting • Job rotation • Team lifting
Conveyor (flipping loose bundles, moving bundles to adjacent table/conveyor)	Heavy Lifting (with twisting)	* 2-person flipping

Other significant improvements

Good housekeeping

The shingle manufacturing process deposits a lot of loose granules on the floor of the plant and horizontal surfaces on the equipment. The housekeeping of the plant is a positive characteristic to mention. Good housekeeping as noticed at this worksite prevents employees from several hazardous conditions such as trips and falls, unnecessary motions and awkward postures. A clean and organized working environment may also improve the morale and positive attitude of the employees.

****