Case Studies in Using Ergonomic Analysis Tools

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Provide examples of ergonomic risk assessments that required use of some typical tools.

- Task description
- Task parameter measurements
  - Time
  - Force
  - Distance
- Assessments to quantify risk or change in risk.
Reel Palletizing
Reel Palletizing –
Task Description & Information

- Reels are doffed from take-up and stacked on a pallet. Reel size and cycle time varies by order.
- 24 associates do this task.
- During last three years, 6 recordable MSDs were reported.
- Pallet handling is the only other manual handling task.
- Task involves a lift, carry and lower.
Measuring Hand Heights

- Height above floor in inches at start of lift and the end of the lift.
- Hand height for carry.
- Height above floor in inches at start of lower and the end of the lower.
Distances Lifted or Lowered

- VERTICAL distance in inches that the hands (or center of mass of the object) move.
- Calculate the difference in Start Height and End Height in inches.
Distance Carried

- HORIZONTAL distance measured in feet the object is moved.
- Shortest push, pull or carry distance covered by psychophysical research is 7 feet.
- For this task it is 18 feet.
Hand Distance

- For psychophysics evaluation hand distance from the body is usually half the width of the object.
  - If held away from the body, use distance from chest or from toes.
  - If leaning over an obstruction, use the distance from the obstruction.

- For NIOSH Lifting Equation.
  - From spine to center of the load.
  - Measured based on center point of line between ankles.
Wire Reel Handling – Hand Distance
Object Weight

- Easily measured with a simple scale. Most manual handling assessment models use static weight.
- If weights vary, better to use the heaviest unless a case can be made for using an average.
Reel Palletizing– Weight

- This full reel weighs 44 pounds (20 kg).
- Others weigh up to 101 pounds.
Frequency - One Task Every….

- Seconds, Minutes or Hours
- Single component task
- Multiple component task
  - Can be different for different components.
- Palletizing or stacking task
  - Psychophysics - Frequency is the total time to palletize or stack divided by the number of pieces.
  - NIOSH - Frequency is the total time to palletize or stack divided by the number of layers, or unique positions.
Reel Palletizing – Frequency

- Measurement can be validated from multiple sources.
  - Watch
  - Process equipment settings
  - Job measurement data
  - Production records
  - Video
- This size reel is doffed every 5 minutes.
Psychophysical analysis indicates twisting is or is not a risk factor depending on whether the twist is > 15 degrees.

Twist is defined as the measure of the angle between the shoulders and the hips.

In the NIOSH Lifting Equation twisting is defined based on the angle of asymmetry.
The Angle of Asymmetry
Less than 15° difference in shoulder and hip angle for lift and lower.
Reel Palletizing Task Evaluation

- For the 44 pound reel, 29% of the Female Population can do this task without significant risk of overexertion.
- For the 101 pound reel, less than 10% of the Male Population can do this task without significant risk of overexertion.

Graph data is from Computask™
Push/Pull Force Comparison

- Does a design change reduce the forces required to use a material handling aid?
- In this case, increase from 8” to 10” diameter wheels on a hand truck.
Force Data Collection Process

Transfer data to laptop for analysis
Peak Forces Reduced 12%

Pulling Original Prototype Up Stairs

Pulling New Prototype Up Stairs

Pulling Original Prototype Up Stairs Forces By Step

Pulling New Prototype Hand Truck Up Stairs Forces By Step
In Summary

- Start with the basic tools revealed as commonly used or desired by ergonomists.
- Develop or adjust the tools in your kit in order to:
  - use the assessment tools of choice, and
  - answer the questions that have or should be asked.
- Goal: Improve the job – Ergonomics!