Manufacturing Ergonomics Learning Objectives

# Introduction

* **Understand the concept and benefits of collaborative ergonomics in manufacturing.** The sources emphasize the importance of involving all stakeholders – workers, management, supervision, health and safety, medical, engineering, technical support, and facilities – in identifying ergonomic issues, making recommendations, and implementing solutions. This collaborative approach ensures that ergonomic interventions are practical, effective, and supported by all parties involved.
* **Identify common ergonomic challenges and solutions in manufacturing workplaces.** The sources acknowledge the diversity of manufacturing environments but stress the presence of common elements, such as the use of tools and equipment at workstations. They highlight the need to design workstations that promote neutral postures, optimize reach zones, control forceful exertions, and encourage regular movement and breaks.
* **Recognize the importance of accommodating change in ergonomic interventions.** The sources explain that change can be difficult for individuals due to ingrained habits and routines. They emphasize the need for patience and understanding when implementing ergonomic changes and suggest strategies for helping workers adapt to new work methods and equipment.

# Components

## Part 1

* **Identify the common components found in manufacturing workstations.** The sources explain that manufacturing workstations typically include elements like a worker, a workbench, a seating system, manufacturing instructions, parts and materials, tools and equipment, storage, a trash receptacle, and material handling systems. Additionally, the surrounding work environment, including factors like lighting, noise, temperature, and ventilation, is also a crucial aspect of these workstations.
* **Identify key considerations for seated and standing workstation design.** Seated workstations are generally preferred for tasks requiring precision, foot controls, and minimal force exertion, while standing workstations are better suited for tasks involving heavy lifting, frequent reaching, and mobility. Factors like work surface height, clearance, and adjustability should be tailored to the specific demands of the task and the anthropometrics of the worker.
* **Apply ergonomic principles to a case study involving workstation redesign.** Through a case study of a Casting Assembly Workstation, learners can analyze ergonomic challenges and evaluate the effectiveness of implemented solutions. This practical application reinforces the importance of considering worker posture, tool design, and material handling in optimizing workstation ergonomics.
* **Describe the benefits and applications of ergonomic design resources, such as checklists and guidelines.** Ergonomic design resources provide a structured approach to identify potential issues and ensure a safe and productive work environment. For instance, checklists can prompt considerations about workstation setup, tool design, and material handling.

## Part 2

* **Identify the historical progression and ergonomic implications of hand tools.** From rudimentary stone, wood, and bone tools to modern battery-powered devices, the evolution of hand tools has significantly impacted worker safety and productivity. This objective encourages understanding of this evolution and its relevance to contemporary ergonomic principles.
* **Identify the ergonomic challenges associated with the transition from manual to power tools in manufacturing.** While acknowledging that power tools reduce manual force requirements, the sources point out they introduce new ergonomic challenges. For instance, torque reaction forces, generated when a fastener reaches its limit, can be transferred to the operator, necessitating the use of clutches and torque reaction bars to mitigate this risk. Additionally, the sources emphasize that power tools often expose workers to hand-arm vibration, potentially leading to decreased sensitivity and muscle contractions.
* **Describe the ergonomic considerations related to tool handle design in manufacturing.** The sources stress the importance of tool handle size in controlling force levels during tool use. They recommend a grip span of 1 ½ to 2 ½ inches (3.8 to 6.3 cm) as ideal, as spans outside this range compromise mechanical advantage. The sources also highlight the influence of friction between the hand and tool handle on grip force, advocating for rubberized coatings, clean surfaces, appropriate gloves, and maintaining normal skin moisture to enhance grip.
* **Evaluate and recommend improvements for grip and hand strength requirements in tool use.** Tool handle size, grip type (power vs. pinch), and the coefficient of friction significantly influence the force required for tool operation. Learners should be able to assess these factors and suggest modifications to reduce strain and improve worker safety.
* **Assess and address contact stress points in workstations and tool design.** Contact stress, arising from sharp edges or prolonged pressure on body parts, can lead to discomfort and injury. Learners should be able to identify these stress points and recommend solutions such as rounding edges, using anti-fatigue mats, and adjusting workstation heights.
* **Analyze case studies to apply ergonomic principles to real-world manufacturing scenarios.** Case studies like the slag removal example provide practical contexts to identify ergonomic risks, brainstorm solutions, and evaluate the effectiveness of implemented changes. This objective emphasizes the application of learned principles to improve workplace ergonomics.

## Part 3

* Learners should be able to **explain the importance of preventive maintenance for tools, equipment, and workstations in maintaining a safe and productive manufacturing environment.** The sources emphasize that preventive maintenance is critical for worker health, safety, and productivity. For instance, failing to maintain equipment like forklifts can lead to them being unavailable when needed for tasks, increasing the risk of musculoskeletal injuries from manual handling of heavy items.
* Learners should be able to **identify and analyze common ergonomic risk factors associated with manufacturing tasks, such as awkward postures, repetitive motions, forceful exertions, vibration, and contact stress.** The sources provide examples of such risk factors, including those associated with tasks like manual metal assembly, material handling, and working with microscopes.
* Learners should be able to **apply ergonomic design principles to optimize the design and layout of manufacturing workstations, considering factors such as adjustability, reach distances, work heights, and clearance for movement.** For example, sources recommend that workstations be adjustable to accommodate different worker statures, allowing for neutral body positioning and promoting work within the "Power Zone," the area closest to the body where workers can exert the most force safely and efficiently.
* Learners should be able to **develop and implement strategies to control or eliminate exposure to workplace environmental hazards in manufacturing, such as extreme temperatures, noise, poor air quality, and inadequate lighting.** Sources recommend specific measures like providing adequate ventilation, using task lighting to reduce glare and improve visibility, and implementing noise control measures such as sound-absorbing materials.
* Learners should be able to **select and recommend appropriate material handling equipment and systems based on ergonomic principles, considering factors such as load weight, frequency of use, travel distances, and the characteristics of the materials being handled.** The sources provide specific guidance on factors to consider when selecting carts and conveyors, such as caster types, handle heights, and load capacities.

# Ergonomics Risk Screen

* **Understand the function and application of the Ergonomics Risk Screen (ERS).** The ERS is a posture-based assessment protocol that provides an overview of the risk factors related to the physical performance of repetitive job tasks. The ERS utilizes an Excel spreadsheet to document and calculate risk. There are three versions of the ERS available: a comprehensive version and two condensed versions with different formatting options.
* **Identify the steps involved in conducting an ERS.** The ERS process includes identifying the number of ERSs to be conducted, developing a task inventory, and preparing ERS worksheets. It also involves gathering the necessary equipment, such as personal protective equipment, measurement devices, video recording equipment, and background materials. Scheduling the ERS data collection and estimating the time needed are also essential steps in the process.
* **Learn the scoring system of the ERS and its implications.** The ERS uses a scoring system based on posture, force, duration, frequency, and a time-weighted multiplier. Scores range from 0 to 4 or higher, with 0-1 indicating low relative risk (green), 2-3 indicating medium relative risk (yellow), and 4 or higher indicating high relative risk (red). Scores in the yellow and red ranges suggest a need for additional assessment and intervention.
* **Identify common ergonomic risk factors in manufacturing jobs.** Risk factors can include awkward postures, high force exertion, prolonged static postures, and repetitive motions. Other factors that can influence the performance of a task include production quality, training, vibration, environmental conditions, contact stress, time spent standing, lighting, visual demands, and the use of foot controls. Additionally, the workstation, equipment, fixtures, jigs, controls, and tools can contribute to ergonomic risks if they are not designed or used correctly.
* **Develop and implement corrective actions to address identified risks and understand the importance of follow-up evaluations.** Corrective actions aim to enhance health, safety, and productivity by implementing changes based on the ERS findings. When implementing solutions, it is essential to prioritize controlled and measurable changes, focusing on one or a few modifications at a time to effectively assess their impact. Following the implementation of corrective actions, ongoing outcome evaluations are crucial, comparing performance measures at set intervals (e.g., 1, 3, 9, and 12 months) to the initial performance measures. This iterative process allows for adjustments and modifications based on the results observed, ensuring continuous improvement in ergonomic conditions.

# Manual Material Handling

* **Understand the prevalence and implications of manual material handling (MMH) injuries in the workplace.** According to the Bureau of Labor Statistics, back injuries represent a significant portion of workplace injuries and illnesses, with a majority affecting the lower back and stemming from MMH tasks.
* **Identify key factors that influence the risk of injury during MMH tasks.** Several factors influence how much weight a person can safely lift, including horizontal distance, frequency of lifts, duration of lifting, spine twisting, vertical distance of lifting origin and destination, item/box size, grip on the box, and the actual object weight.
* **Utilize the LNI Lifting Calculator to assess the risk associated with specific MMH scenarios.** The LNI Lifting Calculator is a tool used to evaluate lifting tasks based on factors like object weight, horizontal distance, lifting frequency and duration, spine rotation, and object size and grip.
* **Apply the LNI Lifting Calculator to a case study and interpret the results.** By working through a case study, learners can practice using the LNI Lifting Calculator to determine if a given lifting task poses a potential hazard and requires intervention.
* **Explore various control methods and intervention strategies to mitigate MMH risks.** Control methods for MMH include administrative controls like two-person lift policies and training, engineering controls like mechanical lifting devices, and individual controls like proper body mechanics.