AMERICAN SOCIETY OF SAFETY PROFESSIONALS
Oklahoma City Chapter

AIHA | Oklahoma LOCAL SECTION

Controls. Controls.
You must learn controls.

Ergonomic Controls

2024 OKC ASSP - AIHA OK PDC

Friday April 14th, 2023

Gary Downey, MS, PE, CPE
GLDowney@ncsu.edu

NC STATE UNIVERSITY

The Ergonomics Center

- Not-for-Profit organization founded in 1994
- Part of NCSU's Industrial & Systems Engineering department
- Nationwide occupational ergonomics
  - Consulting
  - Training
  - Applied research

EDWARD P. FITTS DEPARTMENT OF
INDUSTRIAL AND SYSTEMS ENGINEERING

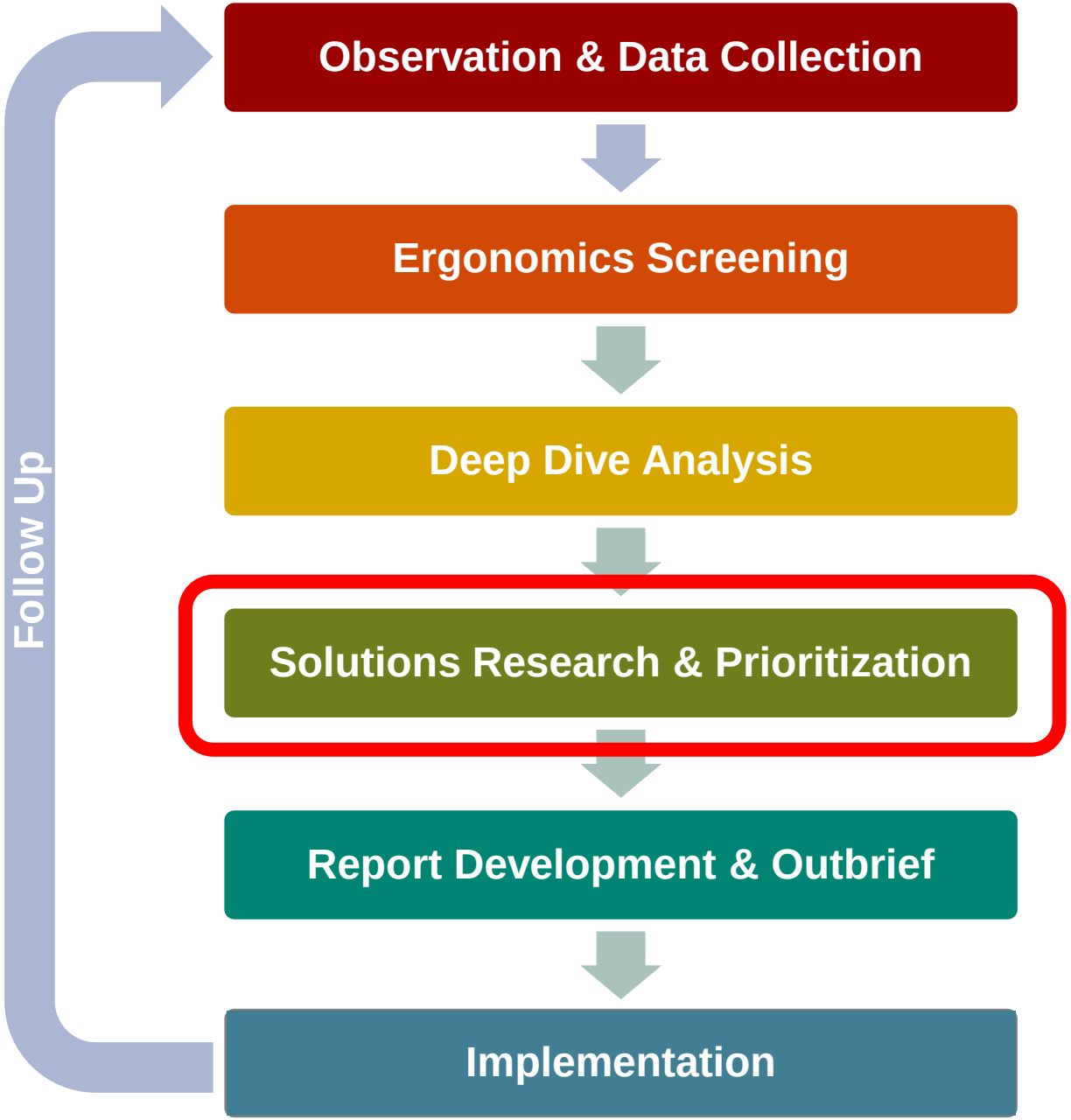
What is Ergonomics?

Ergonomics is the **study of work** in an effort to:

1. **Improve employee well-being**
2. **Optimize system performance**

} ***Fitting the task to the person***

Creating a Balance



Ergonomics Evaluation Pathway

Ergonomic Stressors

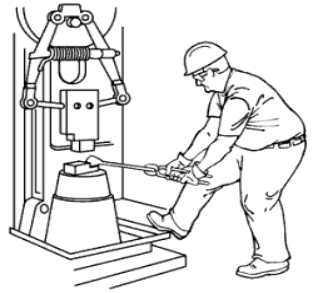
1. **Excessive Force**
2. **Awkward Posture**
3. **Movement Extremes**

The Big 3

- Repetitive Actions
- Static or Sustained Efforts

4. **Work Environment**

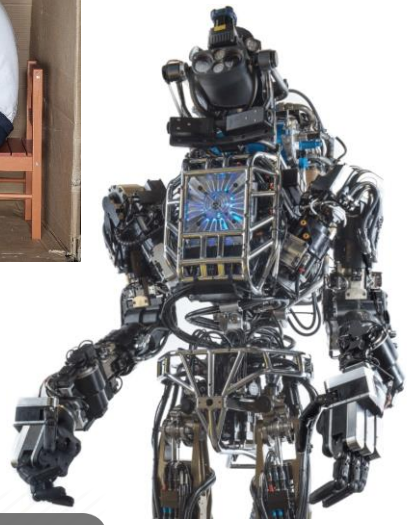


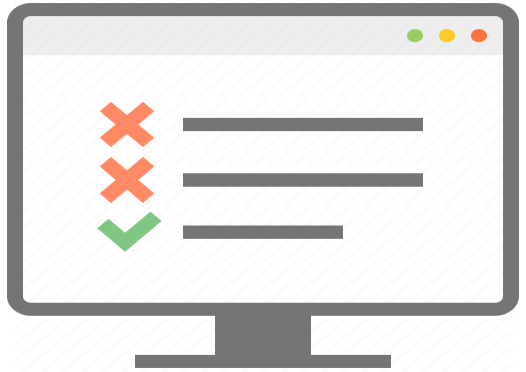



Multiple stressors = Greater chance of injury

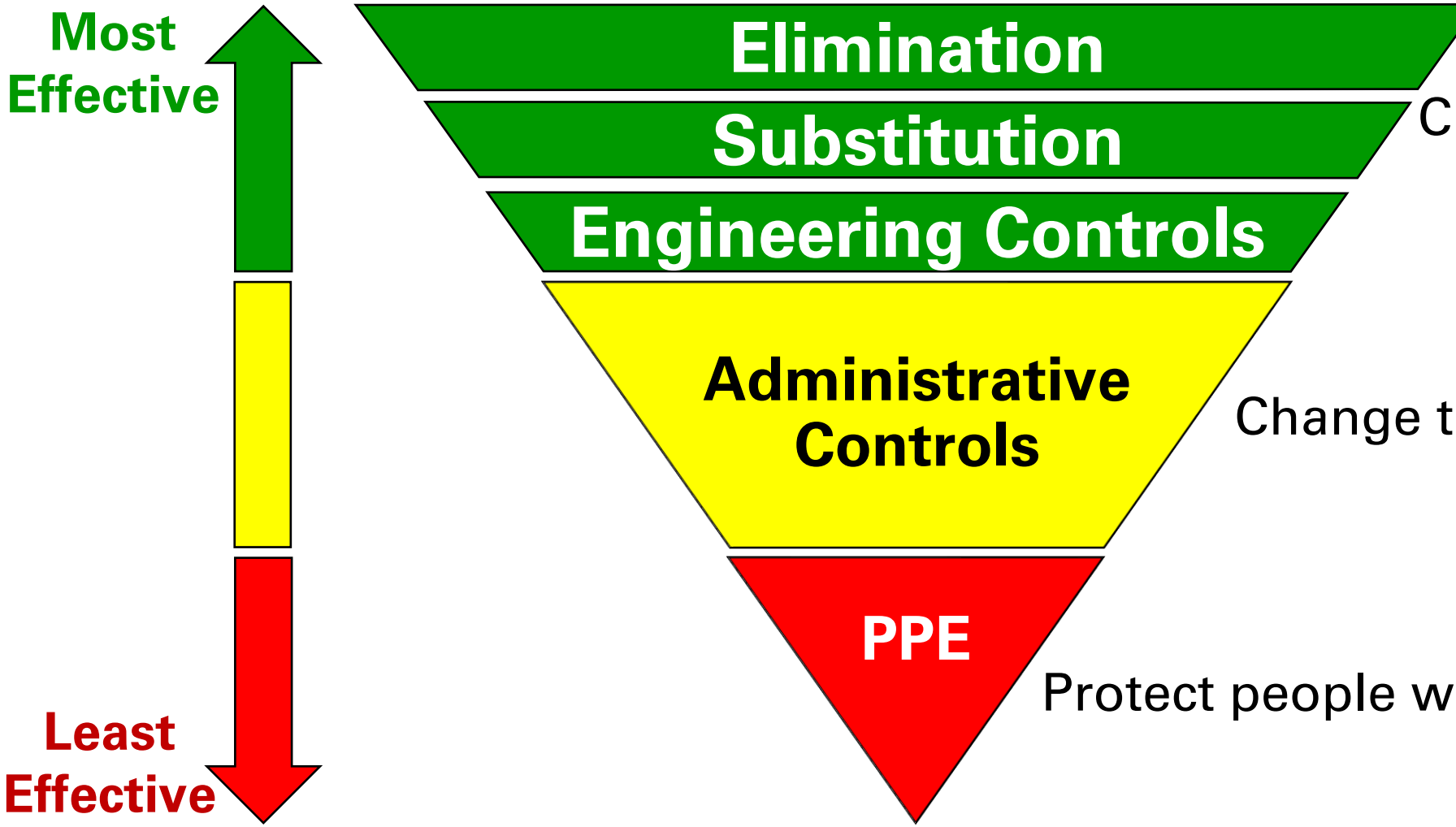
Ergonomics Controls are NOT

- Using oneself as the model for design
- Purchasing expensive equipment
- Always the right solution the first time





Ergonomic Controls and Hierarchy

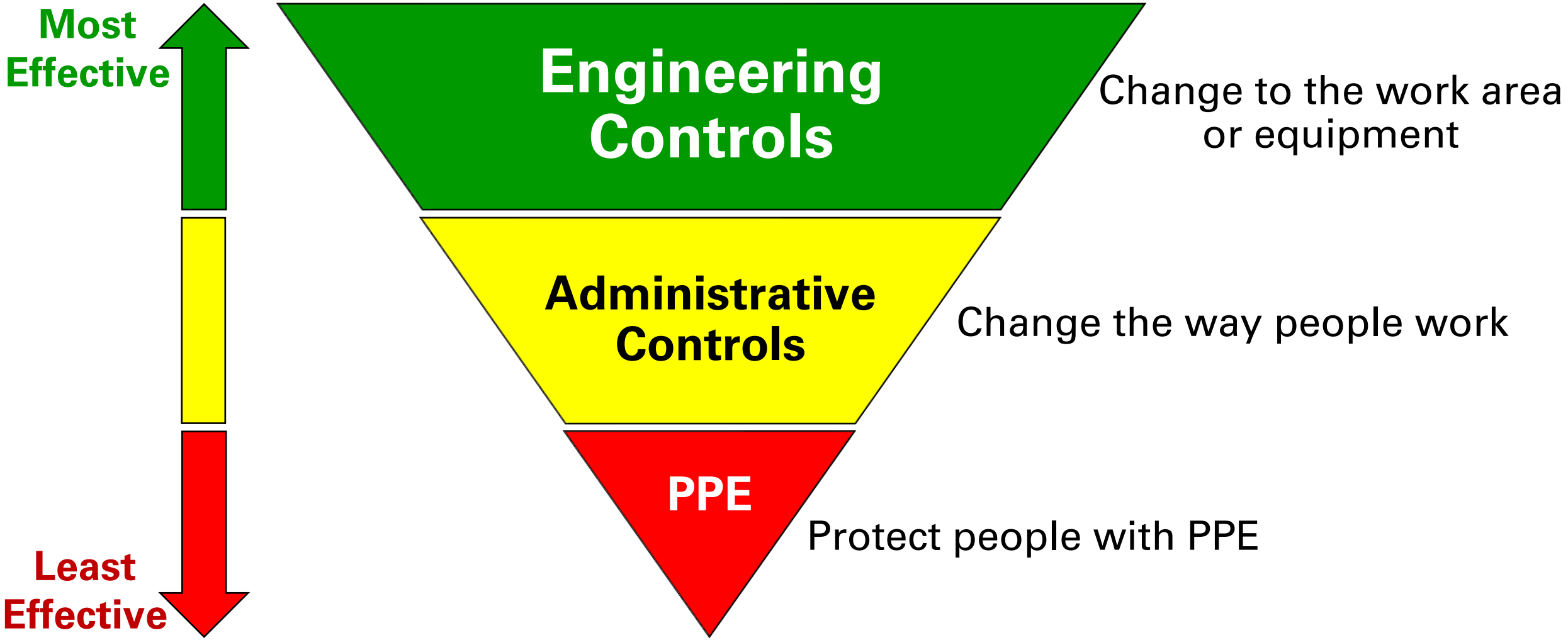


Change to the work area or equipment

Change the way people work

Protect people with PPE

Ergonomic Controls and Hierarchy

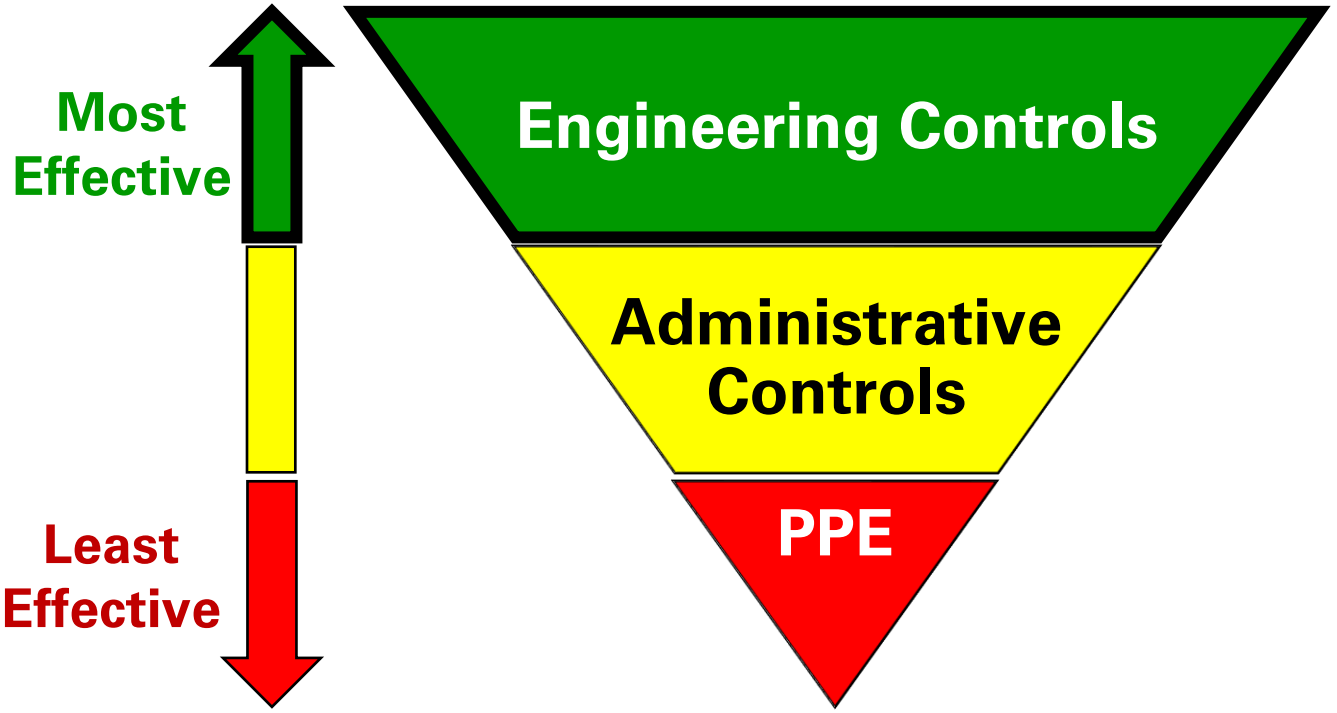


Engineering Controls

Changes made to workstations, products, tools, machinery, or the work environment that alter the physical composition of a work area/process

Examples include:

- Pallet Lifts
- Shelving Adjustment
- Power Tools
- Hooks & Reachers



Engineering Controls

The goal behind selection of good ergonomic engineering controls is to eliminate or greatly reduce the stressors that contribute to musculoskeletal disorders

A good control provides the *opposite* of the stressor…

Stressor	Engineering Control Example
Awkward Posture	Raise the Load to Work in the Power Zone
Excessive Force	Provide Push Assistance
Repetitive Motion	Provide a Power Tool

Work in the Power Zone

The Power Zone

Shelved Location

Angled Gravity-Fed Shelving

Work in the Power Zone

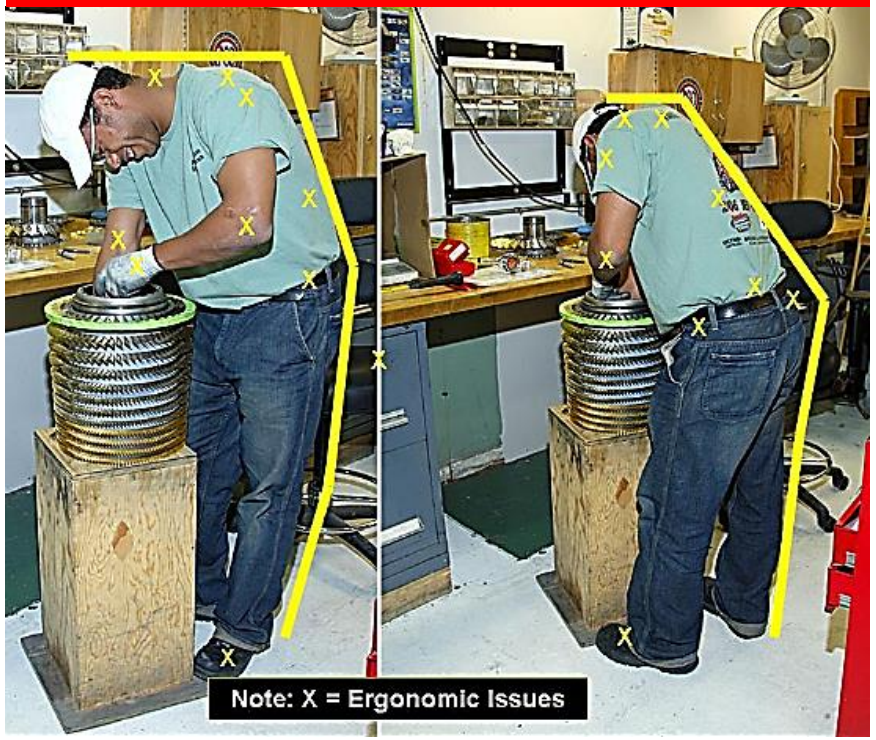
Tilt Stands

Adjustable-Height Work Benches

Tilters

Engineering Controls Example

BEFORE



Static back & neck flexion cleaning engine compressor

AFTER

Height & tilt adjustable work stand with Lazy Susan fixture to eliminate awkward postures

Raise the Load

Pallet Lifts

Stacked Pallets

Raise the Load

Load Lifters

Lift Carts

Stackers

Engineering Controls Example

BEFORE

Lifting and/or carrying heavy or bulky items to/from truckbed

AFTER

Self-Loading Height Adjustable Pallet Jack
(www.innoliftusa.com)

Raise the Worker

Step Stools

Portable Steps

Raise the Worker

Platforms/Scaffolding

Personnel Lift Vehicles

Lower & Support the Worker

Anterior Supports

Stools

Creepers

Engineering Controls Example

BEFORE

Awkward overhead reaching & squatting posture to polish canopy

AFTER

Height & tilt adjustable creeper to eliminate awkward arm and squatting posture

Improve Access

Lowered Container Sides

Turntables (Lazy Susans)

Improve Access

Worksurface Cutout

Vertical Carousels

Automated Storage & Retrieval Systems

Support the Container

Drum & Pail Tippers

Drum Lift Carts

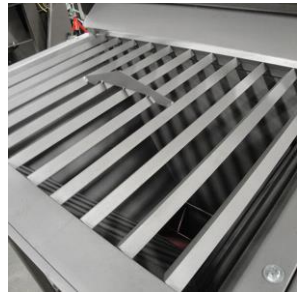
Pumps/Siphons

Support the Container

Manipulators

Vacuum Lifts

Cranes & Hoists



Screens/Grates

Support the Container

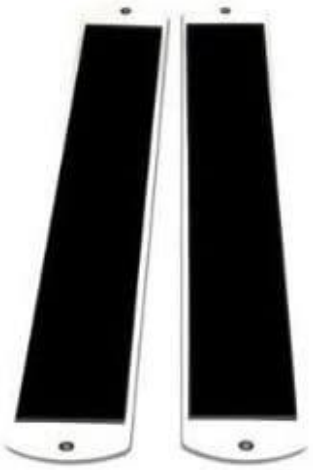
Pallet Dispensers

Pallet Inverters

Provide Push/Pull Assistance

Carts

Dollies



Pallet Sliders
(Furniture Slides)

Provide Push/Pull Assistance

Automatic Guided Vehicles

Powered Pallet Jacks

Engineering Controls Example

BEFORE

Pushing or pulling with high force (i.e. leaning to push or pull)

AFTER

Powered Pallet Jack Converter

http://powerhandling.com/powerpallet-2000/

Provide Push/Pull Assistance

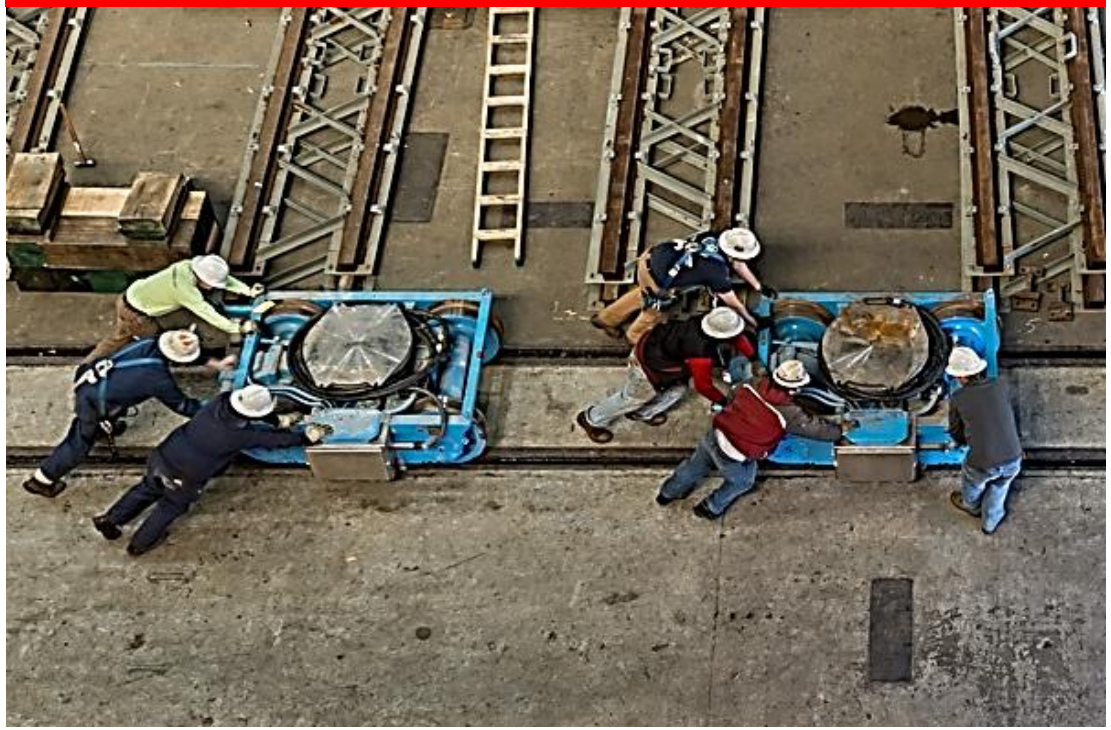
Tuggers

Pushers

Forklifts

Engineering Controls Example

BEFORE



Manually push transfer cars

(380+ lb init. force, 150+ lb of sust. force)

AFTER

Power Pusher

Provide Push/Pull Assistance

Conveyors

Slides & Chutes

Skate Wheel Conveyors

Provide Push/Pull Assistance

Conveyance Tops

Roller Balls

Air Ball Tables

Engineering Controls Example

BEFORE

AFTER

Provide Packaging Assistance

Packaging Manifesto Workstations

Automated Packaging Equipment

Semi-Automatic & Fully Automatic Wrappers

Provide Packaging Assistance

Handheld Stretch Wrap Roll Holders

Stretch Wrap Carts

Stretch Wrap Poles

Provide the Appropriate Tool

Balancers

Torque Arms

Tool Manipulators/Supports

Provide the Appropriate Tool

Alternative Microscopes

Alternative Handles

Hooks & Reachers

Provide the Appropriate Tool

Shovels & Brooms

Air Line Slide Valves

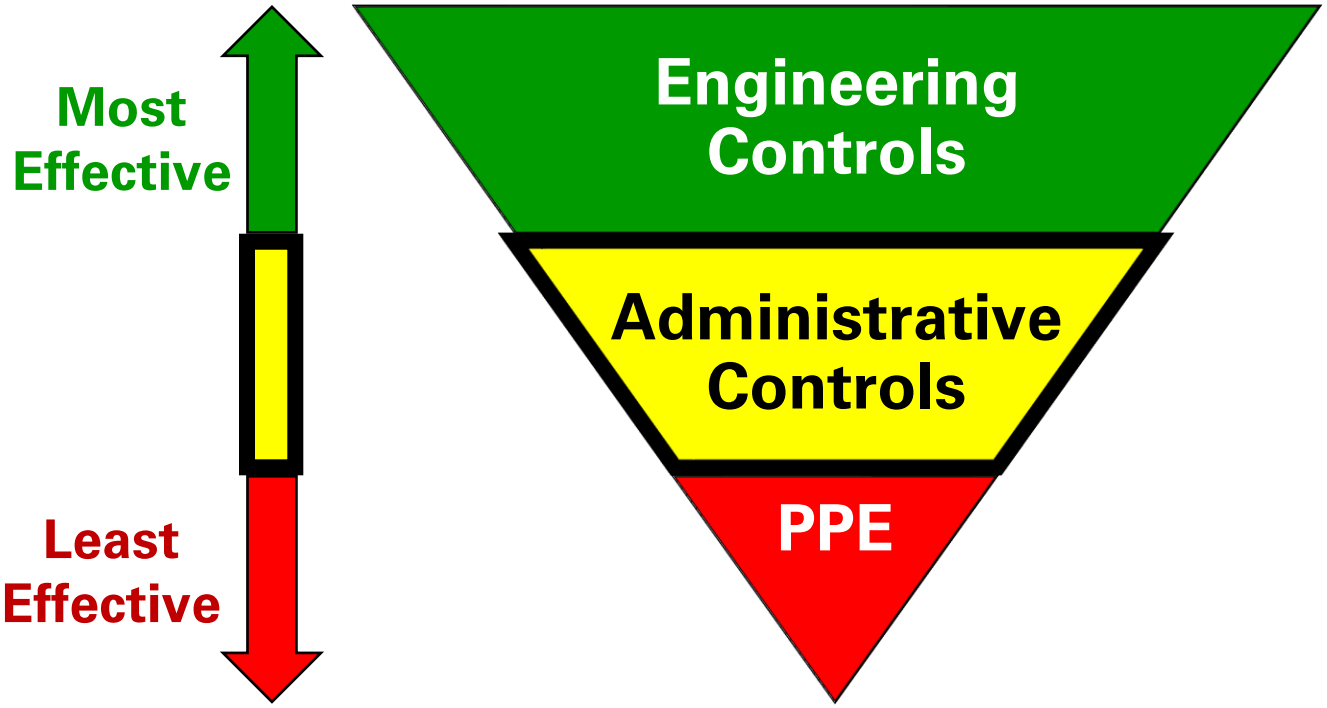
Portable Valve Actuator Tools

Administrative Controls

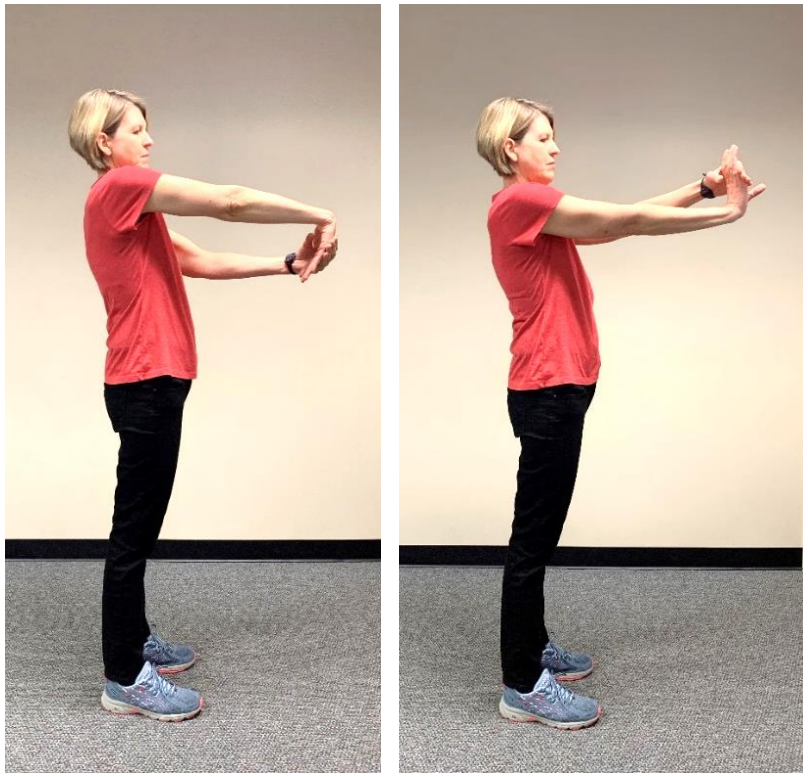
Regulates exposure to ergonomic stressors ***without*** *making physical changes* to the work area or work process

Examples include:

- Stretching Exercises
- Job Rotation/Enlargement
- Work Practice Controls



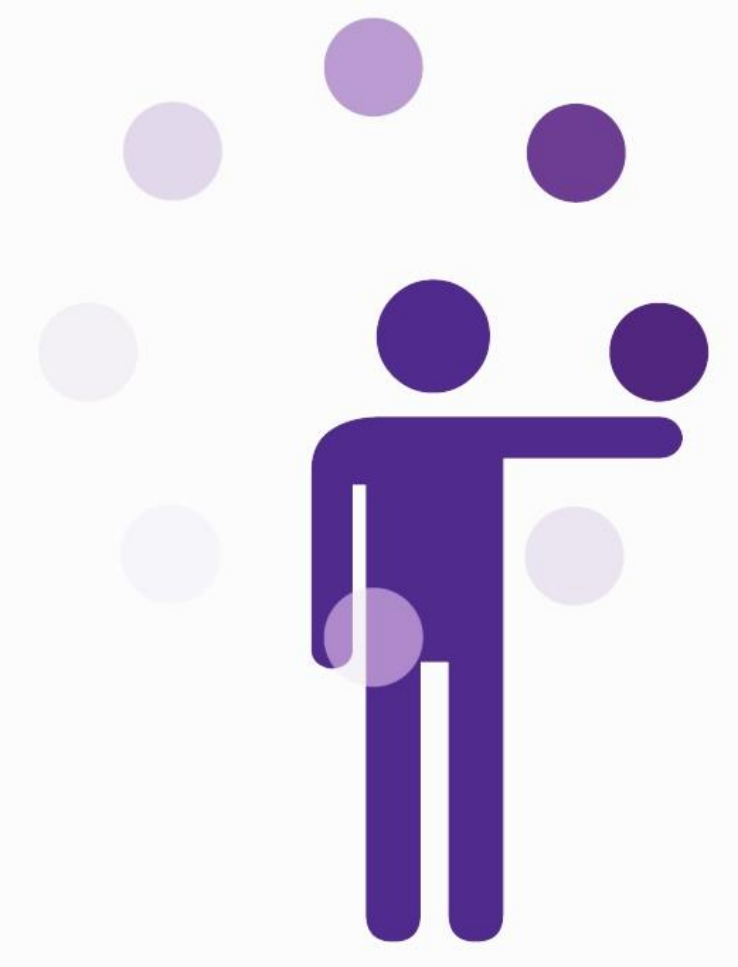
Stretching



- Facilitates blood flow
- Warms up muscles
- Offers a break from activities
- Dynamic stretches favored
- Customize for task

As with any exercise program, a certified physician or physical therapist should be consulted before beginning or increasing the parameters of an exercise program.

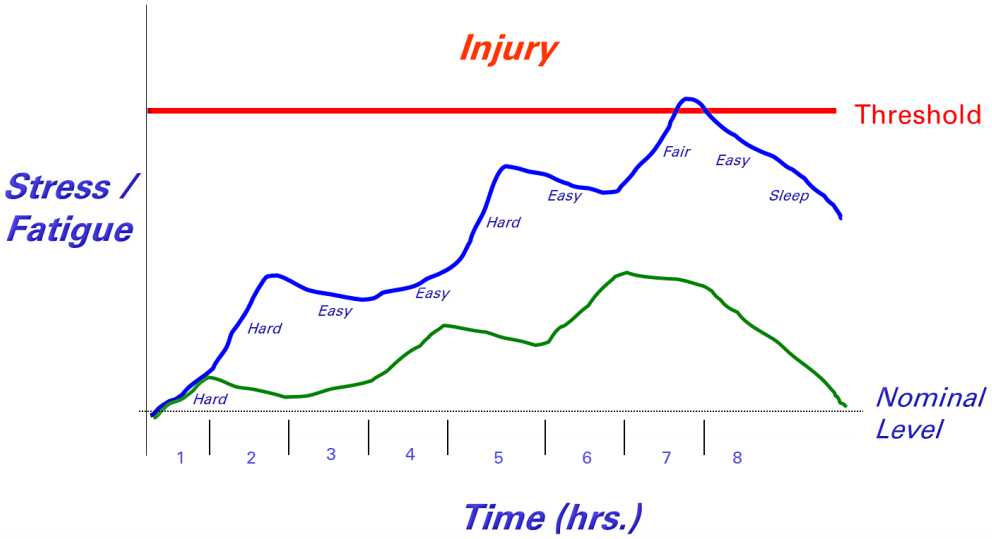
Job Enlargement



- Expand the number of tasks performed by a worker to reduce repetition affecting individual body parts
- Provide musculoskeletal variety offers recovery time for individual muscle groups

Job Rotation

- **Distributes stressors** between a group of employees
- Can be **implemented quickly**
- **Reduces exposure time to stressors** causing musculoskeletal disorders
- Provides **recovery** from localized muscle fatigue by utilizing **musculoskeletal variety**

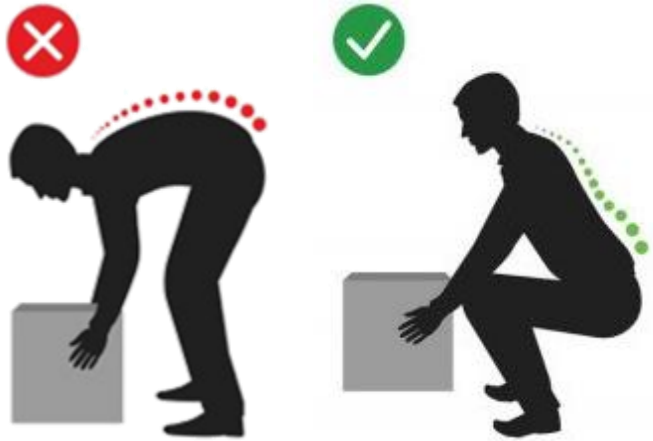


Work Practice Controls

An **Administrative Control** that *changes the way employees perform job activities* to reduce exposure levels

Examples include:

- Methods Training
- Workstation Features Training
- Ramp In Conditioning or Work Hardening



Lifting Tips

If you do have to lift:

- Clear a path to your destination
- Avoid stairs, stools, and ladders
- Secure a good grip on the load
- Keep object close to body
- Neutral back, lift with legs
- Keep eyes up
- Use smooth lifting motion
- Move feet instead of twisting
- Get help if you need it!

MMH Tips

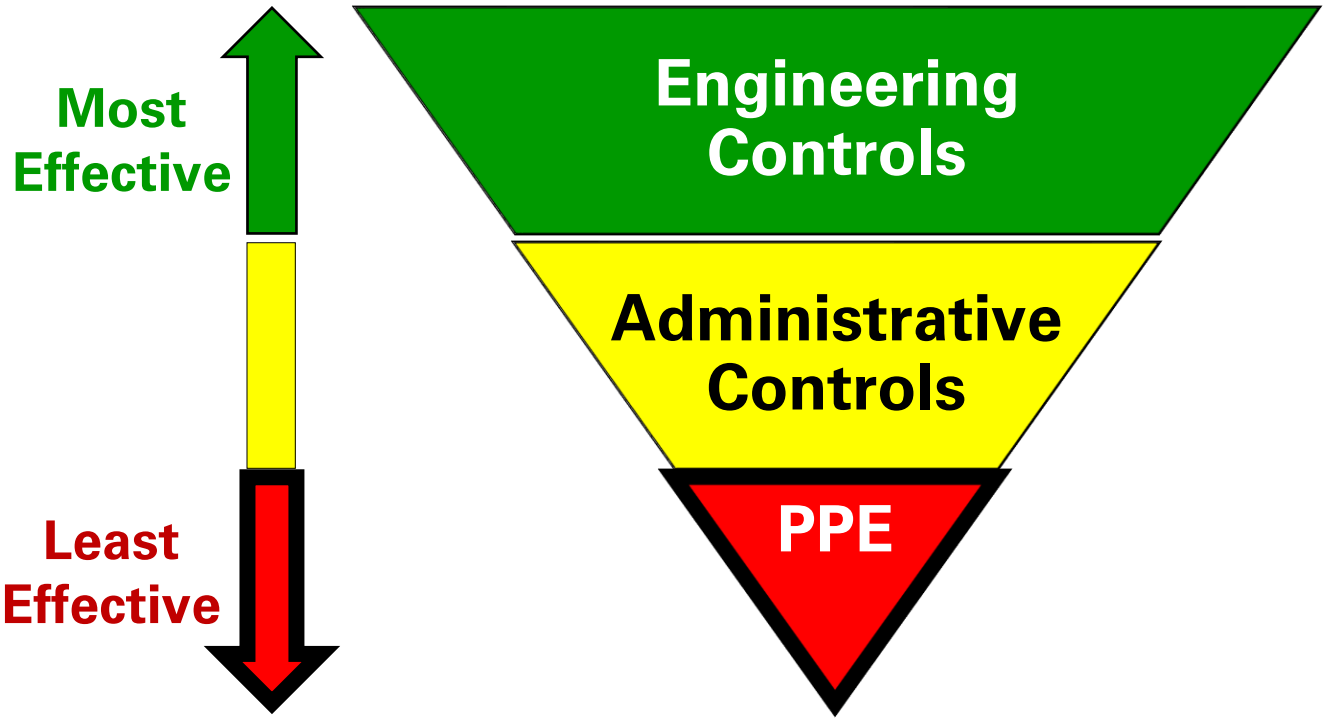
- Avoid awkward back postures by storing products at waist level
- Slide products instead of lifting
- Push instead of pull
- Keep motions smooth and controlled
- Get assistance when moving heavy or bulky objects
- Avoid awkward grips and hand/wrist postures
  (Use power grip vs. pinch grip and keep wrists straight)

Personal Protective Equipment (PPE)

Equipment worn to minimize exposure or impact of certain risks; places a barrier between the worker's body and the risk

Examples include:

- Padding
- Anti-fatigue Insoles
- Vibration Damping
- Gloves
- Cooling / Warming Vests



Padding & Anti-Fatigue Insoles

Consider **padding, anti-fatigue mats or insoles** to reduce contact stress & promote circulation

Vibration Damping & Gloves

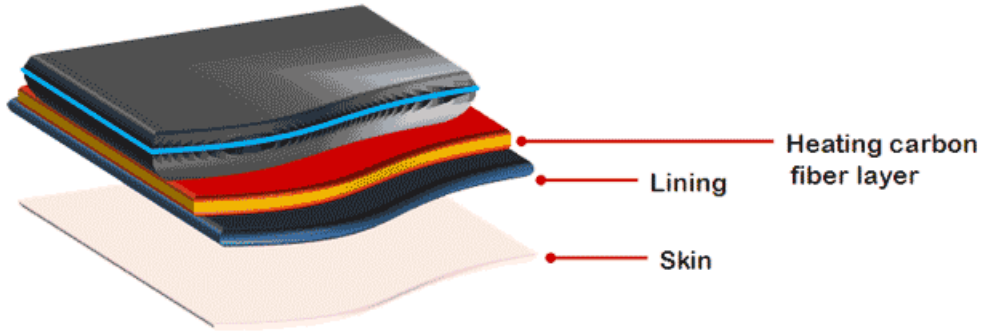
Consider **vibration damping wraps** and/or **anti-vibration gloves** when using tools with high vibration levels:

- Grinders
- Impact Guns
- Rivet Guns / Bucking Bars
- Jack Hammers

Cooling & Warming

- Cooling Vests & Towels

- Heated Clothing



Back Belts

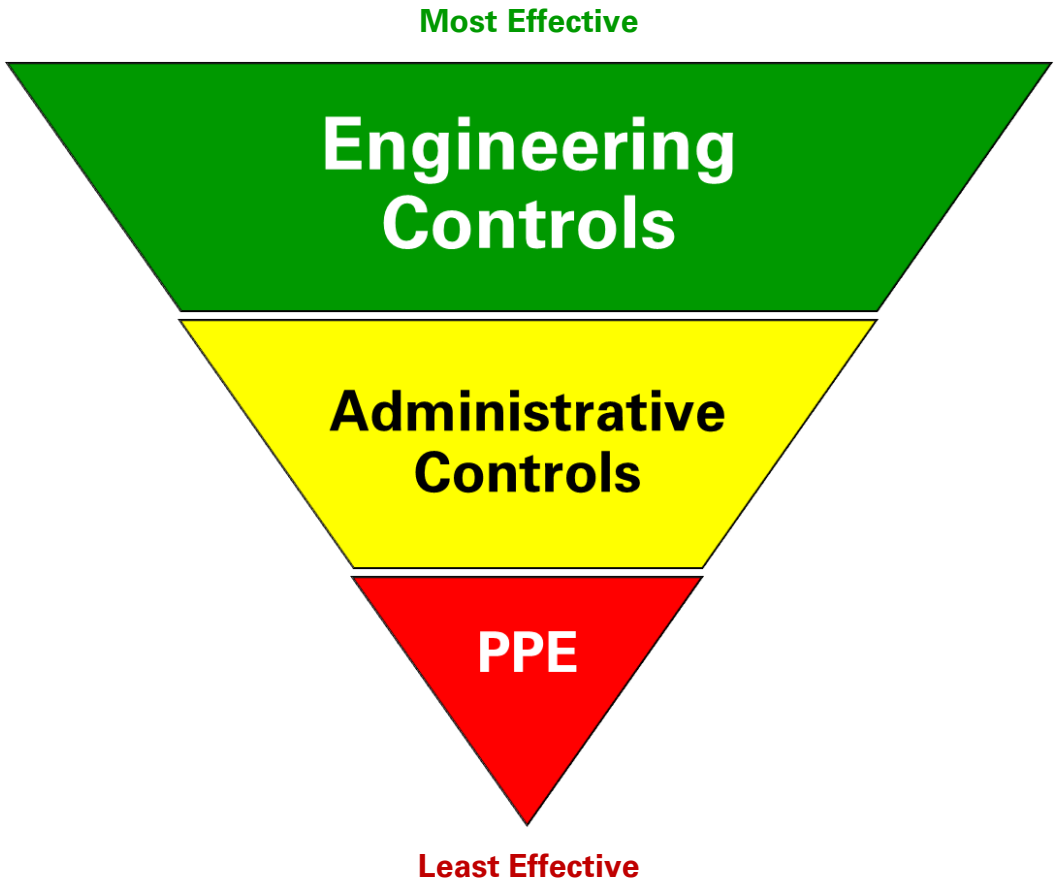
NIOSH, OSHA & The Ergonomics Center **DO NOT** recommend the use of back belts to prevent injuries among workers

Findings on back belts:

- No evidence of reduced injuries
- No evidence of reduced spine forces
- No evidence of reduced forward bending
- Back belts give false sense of security
- Heart rate & energy expenditure may increase with back belt use

Controls Wrap Up

- Engineering controls are preferred over Administrative controls & PPE; they eliminate/reduce stressors
- Administrative controls & PPE do have their place, often as short-term easy-to-implement solutions
- Control implementation is a process
- Expect the need to tweak a newly implemented control based on feedback from employees



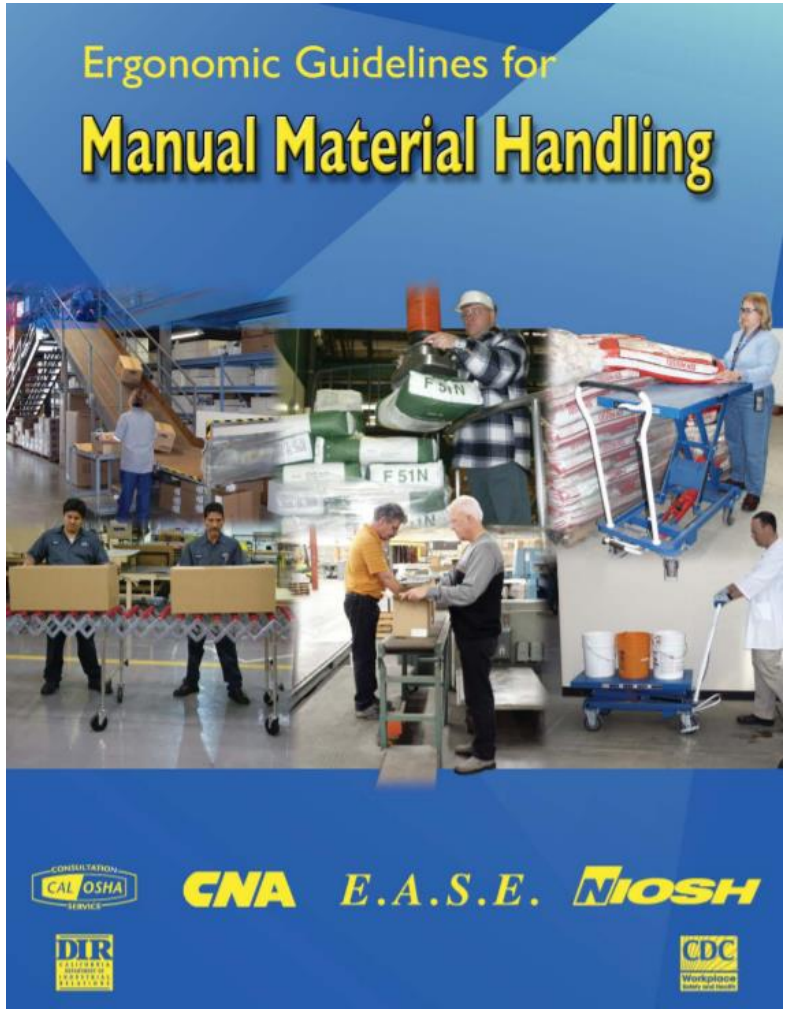
Other Examples of Ergonomic Controls

IISE Applied Ergo Conference

Ergo Cup®

https://www.iise.org/AEC/details.aspx?id=8956

FREE Resource for Material Handling Solutions



67 pages
Full Color
Resource Guide

MHI
THE INDUSTRY THAT MAKES SUPPLY CHAINS WORK®

EASE
Ergonomic Assist Systems & Equipment

NIOSH

www.mhi.org/free/4607

Resources for Controls

- Washington State Dept. of Labor & Industries: https://lni.wa.gov/safety-health/preventing-injuries-illnesses/sprains-strains/
- OSHA Ergonomics - Solutions to Control Hazards: https://www.osha.gov/ergonomics/control-hazards
- CDC / NIOSH Ergonomics Guidelines to MMH: https://www.cdc.gov/niosh/docs/2007-131/
- Canadian Centre for Occupational Health & Safety - Ergonomics: https://www.ccohs.ca/oshanswers/ergonomics
- NIOSH Ergonomics & MSDs: https://www.cdc.gov/niosh/topics/ergonomics/default.html
  - "Ergonomic Interventions by Industry"
  - "Ergonomic Recommendations"

Thank You!

Questions, you have?

Ergonomic Controls

Gary Downey, MS, PE, CPE
GLDowney@ncsu.edu

Ergonomic Controls

Bonus Content

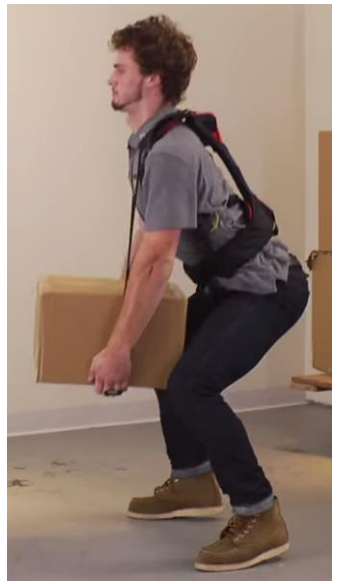
(time permitting)

Emerging Technology

Smart PPE: Exoskeletons

- ASTM F48: “wearable device that augments, enables, assists, and/or enhances physical activity through mechanical interaction with the body”
- Exosuits: similar but have primarily soft and/or elastic structures
- Active vs Passive
- Viewed as PPE (by early adopters)
- Components
  - Shoulder/Arm assist
  - Back assist
  - Leg assist
  - Tool holding/support

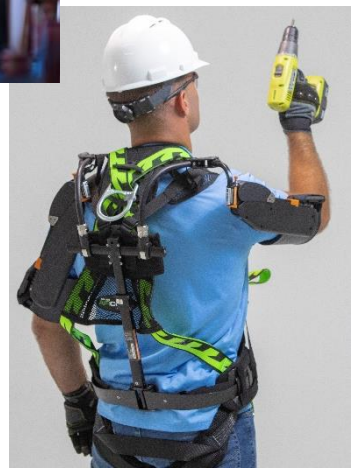
Sarcos Guardian XO



Strong Arm Technologies V22

Smart PPE: Exoskeletons

Ekso Bionics
EksoVest

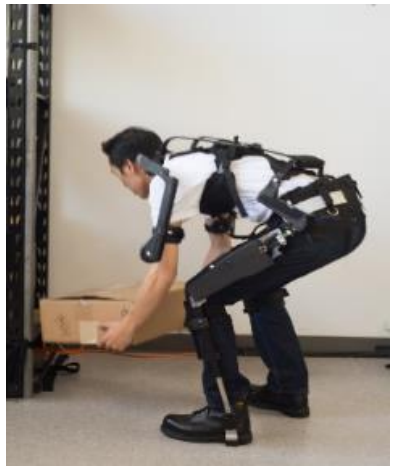


Levitate
Technologies
Airframe

Lockheed Martin
FORTIS

Laevo V2

Noonee
Chairless Chair 2.0



SuitX MAX

Bioservo Ironhand

ASTM F48 Exoskeletons and Exosuits Committee Video

Smart PPE: Exoskeletons

- Research still on-going about use and MSD prevention
- Mostly small research sample sizes and in-field applications
- Try before you buy!
- Things to consider:
  - Task fixed better via engineering control?
  - Sizes (people & exos, adjustability)
  - Training & time (don, doff, adjustment, use, acceptance)
  - Sharing & cleaning
  - Maintenance & storage
- Not a magic bullet…yet!

Emerging Technology Future Direction

(from a Practitioner's Perspective)

Exoskeletons

Wearable Sensors

- Monitors posture/movement/location/proximity; provide tracking/feedback; brain sensors

Computer Vision

- AI enabling computers to analyze postures/tasks, detect objects/damages, track/guide vehicles

Virtual & Augmented Reality (VR/AR)

- VR = full immersion apart from real world, AR = overlays digital info on real world elements
- Design & prototyping; training; manufacturing/maintenance assistance

Data Analytics, IoT, & Connected Machinery

- Design; manufacturing; diagnostics; service/repair

Collaborative Robots (Cobots)

- Work in conjunction with & in close proximity to humans; pick & place tasks; machine tending; tool changes; raw material replacement