



ORCHSE

an **nsc** workplace safety group

Fundamentals of Ergonomics

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Introductions

- A little about me...

- Tell me about you!!

Discussion Outline

- What is Ergonomics?
- Why Implement Ergonomics?
- Musculoskeletal Disorders
- MSD Risk Factors
- Building an Ergonomics / MSD Solution Program

What is Ergonomics?

Ergonomics is the study of work

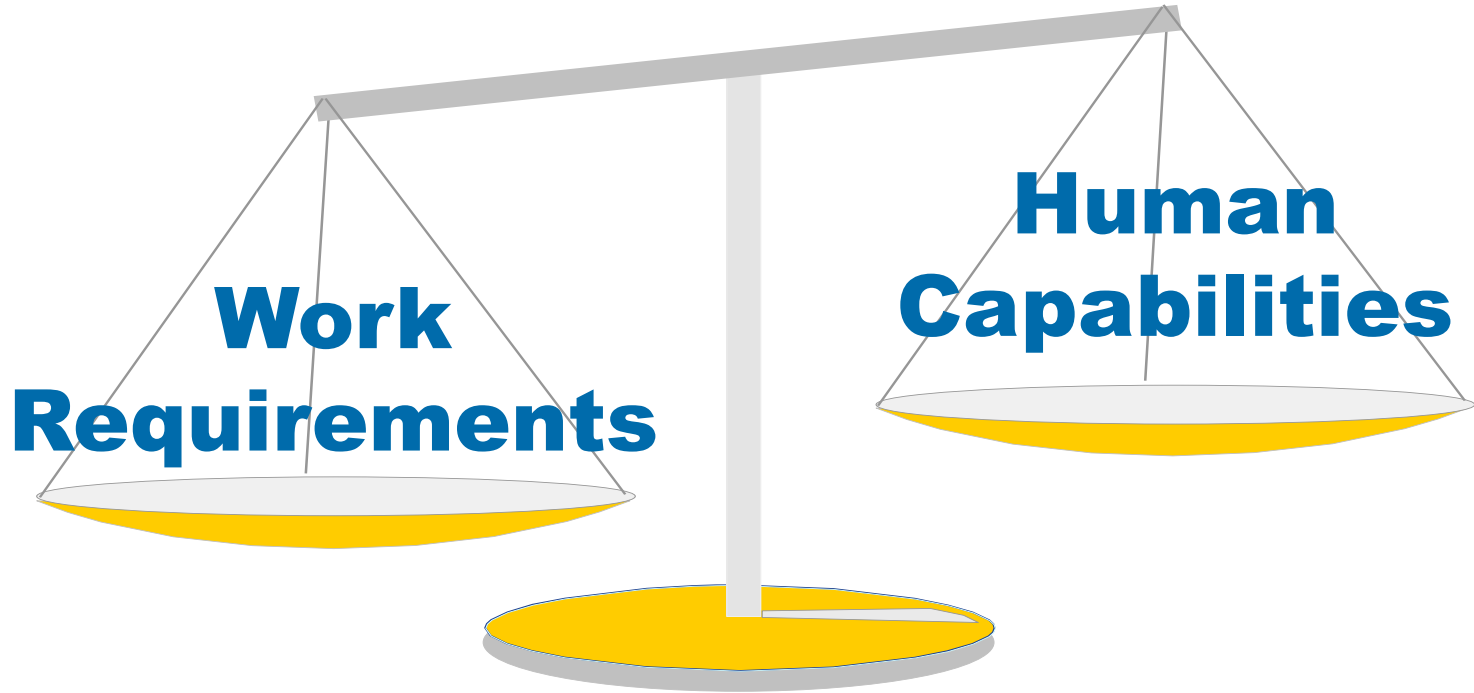
Ergon → Work

Nomos → Laws of

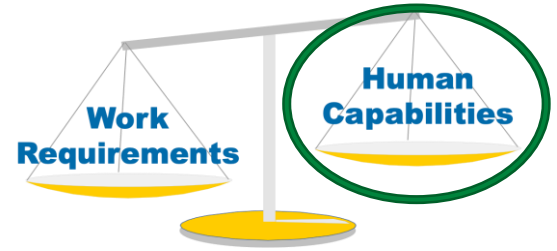
What is Ergonomics?

Ergonomics is an applied science that considers people's abilities, limitations, and characteristics in the design and evaluation of work systems, including tasks, jobs, workstations, tools, equipment, and the work environment.

What is Ergonomics?



What is Ergonomics?



- **Every Human Ability has A Limit**

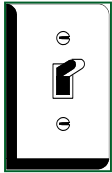
- ✓ Ergonomics endeavors to define these limits and then design work to be within these limits

- **People Are Different**

- ✓ Ergonomics endeavors to understand these differences and use the data to design workplaces that accommodate the greatest possible percentage of the population

- **People Act Predictably**

- ✓ Ergonomics determines which population stereotypes (predictable population patterns of behavior) exist and then ensures that the workplace is designed to be consistent with them



Why Ergonomics?

Ergonomics is an applied science that considers people's abilities, limitations, and characteristics in the design and evaluation of work systems, including tasks, jobs, workstations, tools, equipment, and the work environment.

The goal of ergonomics is to design systems that preserve the wellbeing of all employees, minimize the risk of injury and illness, especially musculoskeletal disorders, and maximize system as well as human performance.

Why Ergonomics?

Musculoskeletal disorders are the largest category of workplace injuries in the US.

The U.S. private sector experienced 266,530 MSD injuries or illnesses involving days away from work in 2019.

According to the World Health Organization, approximately 1.7 billion people have musculoskeletal conditions across the globe.

Musculoskeletal conditions are the leading contributor to disability worldwide, with low back pain being the single leading cause of disability in 160 countries.

Because of population increases and aging, the number of people with musculoskeletal conditions is rapidly increasing.

Why Ergonomics?

Decreased Number and Severity of MSDs & other injuries & illnesses

Reduced Direct & Indirect Costs Associated with MSDs

- Worker's Compensation Costs
- Cost of Managing the Claim
- Employee Retraining
- Increased Overtime
- Reductions in Productivity

Why Ergonomics?

Improved Operational Performance

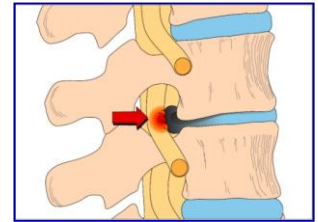
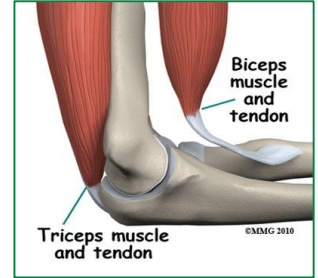
- Improved Quality
- Improved Reliability
- Increased Productivity
- Reduced Cycle Times
- Reduced Errors and Defects
- Reduced Waste
- Reduced Maintenance Costs

Worker Benefits

- Reduced Employee Discomfort
- Reduced Absenteeism
- Improved Employee Job Satisfaction
- Reduced Employee Turnover

Musculoskeletal Disorders

Musculoskeletal disorders (MSD) are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs.



Note: MSDs caused by slip, trips, falls, or other similar accidents are not included in this definition.

Musculoskeletal Disorders

Bones - Make up the Body's Skeleton

Joint - Connection Between Bones

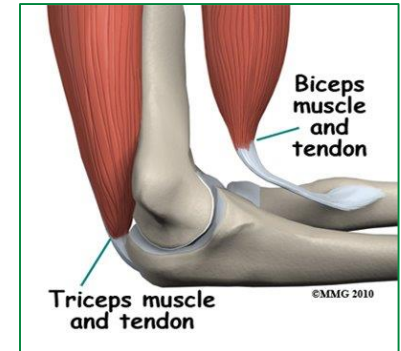
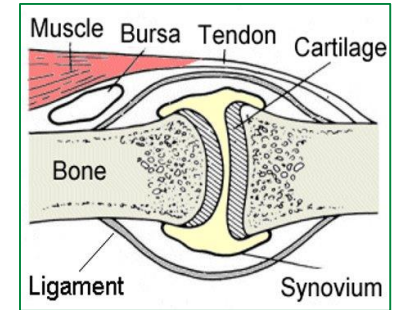
Ligaments - Connect Bone to Bone

Cartilage - Protects the joint surfaces

Tendons - Connect Muscle to Bone

Muscles - Contract to Create Movement

Nerves - Transmit Signals to Muscles
Initiating Contraction



Common Musculoskeletal Disorders

- Sprains (Affect Connective Tissue)
- Strains (Injury to Muscle)
- Muscle Tears
- Tendonitis
- Tennis Elbow (Epicondylitis)
- De Quervain's Disease
- Trigger Finger
- Rotator Cuff Injuries
- Nerve Entrapment Syndromes
 - ✓ Carpal Tunnel Syndrome
 - ✓ Thoracic outlet syndrome
- Back Pain
- Herniated or Ruptured Disc
- Raynaud's Syndrome

MSD Signs & Symptoms

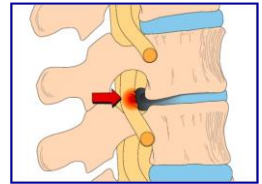
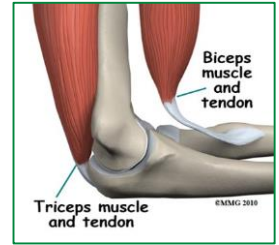
- Pain
- Tenderness
- Swelling
- Redness
- Burning
- Cramping
- Stiffness
- Loss of Strength
- Reduced Range of Motion
- Tingling
- Numbness

Musculoskeletal Disorders

Musculoskeletal disorders (MSD) are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs.

Work-related musculoskeletal disorders (WMSD) are conditions in which:

- ✓ The work environment and performance of work contribute significantly to the condition; and/or
- ✓ the condition is made worse or persists longer due to work conditions



Note: MSDs caused by slip, trips, falls, or other similar accidents are not included in this definition.

MSD Risk Factors

To prevent MSDs,
we identify and eliminate (or reduce)
the risk factors known to contribute to these
injuries & illnesses.

What are risk factors?

MSD Risk Factors

Risk Factors are job attributes or workplace conditions or exposures that increase the likelihood of experiencing an MSD.

The more risk factors that are present in a job or task, the greater the risk for developing an MSD.

MSD Risk Factors

- Force
- Posture
- Repetition
- Contact Stress
- Vibration
- Temperature

Personal Risk Factors for MSDs

- Age
- Fitness Level
- Weight (Obesity)
- History of Injury
- Medical Conditions
- Non-Occupational Activities
- Psychosocial Factors

MSD Risk Factors

Primary
Risk Factors

- **Force**
- **Posture**
- **Repetition**
- Contact Stress
- Vibration
- Temperature

MSD Risk Factors

- High Forces
- Awkward or Static Postures
- Excessive Repetition
- Contact Stress Against Soft Tissue
- Prolonged Exposure to Whole Body or Hand-Arm Vibration
- Cold Temperatures

MSD Risk Factors

- High Forces
 - ✓ Lift/Lower
 - ✓ Push/Pull
 - ✓ Carry
 - ✓ Power & Pinch Grips
 - ✓ Press
 - ✓ Torque

Higher Force = Higher Risk

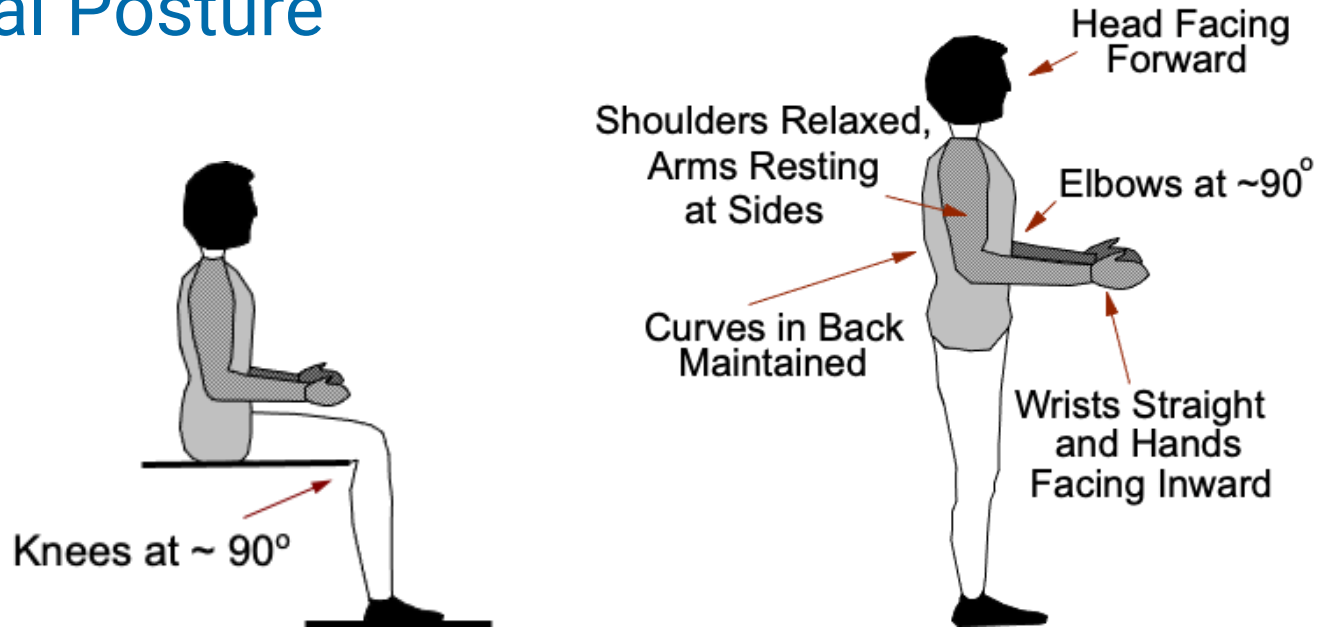
MSD Risk Factors

- Awkward or Static Postures
 - ✓ Posture is “body position”
 - ✓ Neutral posture is the posture where we have the greatest strength and greatest endurance
 - ✓ Awkward postures decrease muscle strength, increase strain on the connective tissues, decrease circulation and increase fatigue
 - ✓ Static posture is holding the same position for a period of time

Greater Deviation from Neutral = Higher Risk

MSD Risk Factors

- Neutral Posture



MSD Risk Factors

Extreme Posture

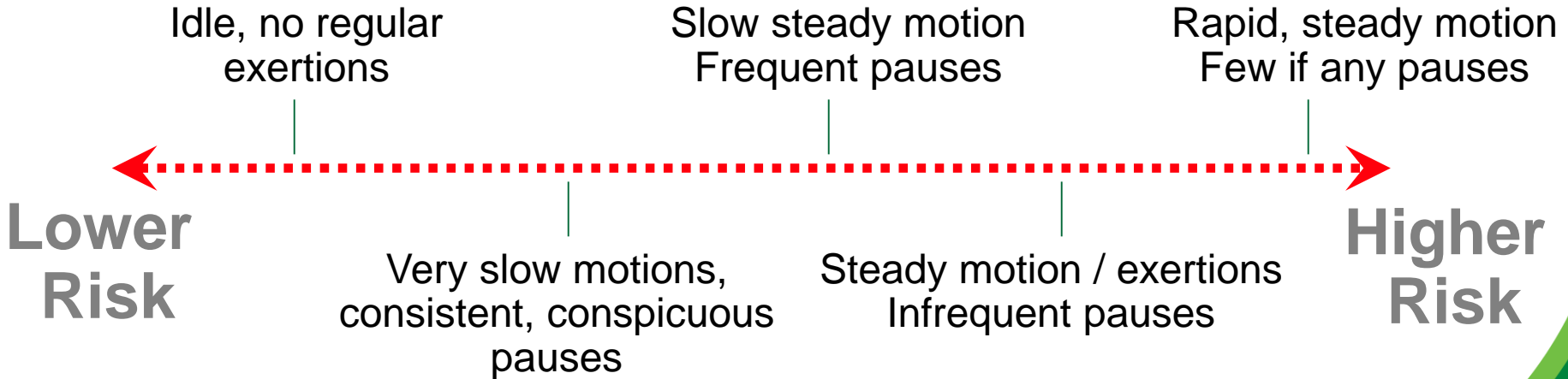
% Strength Reduction

Ulnar Wrist Deviation	25%
Radial Wrist Deviation	20%
Wrist Extension	25%
Wrist Flexion	55%
Arms Fully Extended	81%
Floor Level Lift	40%
High Vertical Lift	60%
45° Twist During Lift	15%
90° Twist During Lift	30%

MSD Risk Factors

- Excessive Repetition

✓ Doing the same motion or movement over and over



MSD Risk Factors

- Contact Stress Against Soft Tissue

Contact stress occurs whenever focused pressure is exerted against part of the body. Compression of nerves and blood vessels can result in reduced circulation or discomfort and fatigue. Common examples include:

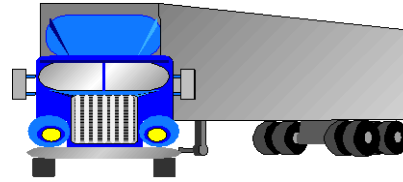
- ✓ Pressure against the hand from sharp edges on tool handles
- ✓ Resting the wrists or forearms on the edge of a work surface
- ✓ Leaning against a work surface
- ✓ Kneeling
- ✓ Sitting in a chair that is too low, too high or too deep
- ✓ Using the hand as a tool

Longer Duration = Higher Risk

MSD Risk Factors

- Prolonged Exposure to Vibration

- ✓ Whole Body Vibration



- ✓ Hand-Arm Vibration



Longer Duration = Higher Risk

MSD Risk Factors

- Cold Temperatures

Low temperatures affect circulation, manual dexterity and grip strength, aggravating other risk factors. Exposure can result from:

- ✓ Low ambient temperatures
- ✓ Handling cold materials
- ✓ Cold air exhaust or cold (metal) handles on tools

Temperatures < 60°F (16°C) = Higher Risk
Longer Duration = Higher Risk

MSD Risk Factors

Risk Factors are job attributes or workplace conditions or exposures that increase the likelihood of experiencing an MSD.

The more risk factors that are present in a job or task, the greater the risk for developing an MSD!

- High Forces
- Awkward or Static Postures
- Excessive Repetition
- Contact Stress Against Soft Tissue
- Prolonged Exposure to Whole Body or Hand-Arm Vibration
- Cold Temperatures

MSD Risk Reduction

To prevent MSDs,
we identify and eliminate (or reduce)
the risk factors in:

- ✓ Workstation
- ✓ Tools
- ✓ Equipment & Machinery
- ✓ Task & Work Practices
- ✓ Work Environment

MSD Risk Reduction



- Optimize the posture of the workers
 - ✓ Seated versus standing
 - ✓ Determine ideal work height
 - ✓ Incorporate adjustability in work or worker
 - ✓ Keep work as close as possible to worker
 - ✓ Provide footrests & anti-fatigue mats
 - ✓ Use work positioners or worker supports
 - ✓ Organize materials & supplies according to frequency of use and weight

MSD Risk Reduction

- Minimize Forces

- ✓ Use mechanical assists devices in MMH
- ✓ Push rather than pull
- ✓ Use conveyors and roller tables
- ✓ Maintain and select proper castors
- ✓ Use power grip over pinch grip
- ✓ Keep cutting tools sharp
- ✓ Use powered hand tools
- ✓ Improve mechanical advantage of tools

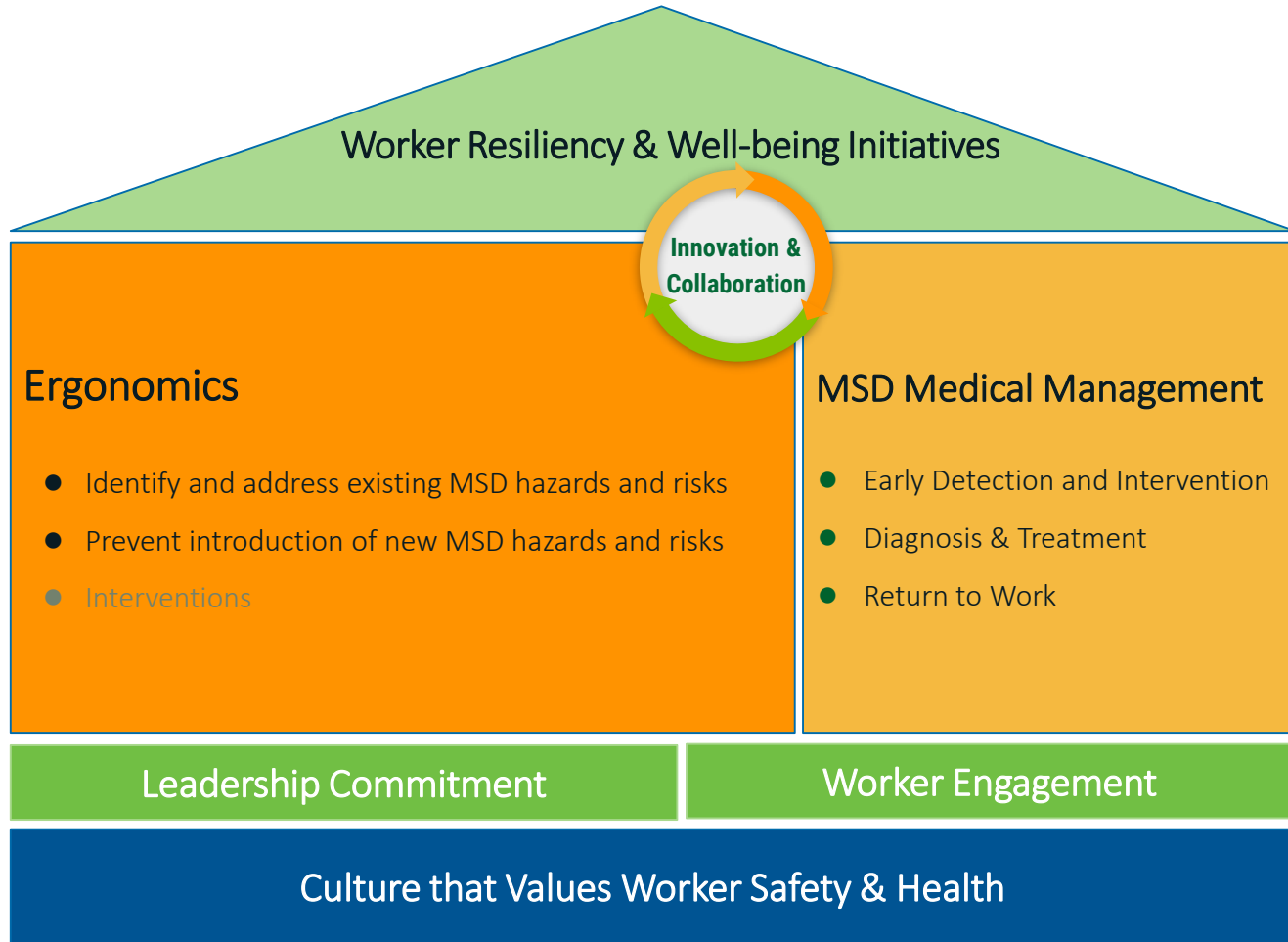


MSD Risk Reduction

- Reduce frequency of exertions
 - ✓ Eliminate re-handling
 - ✓ Purchase materials in quantities and/or weights used
 - ✓ Provide materials in the orientation used
 - ✓ Use powered tools
 - ✓ Organize materials and tools according to sequence and frequency of use
 - ✓ Alternate hands / sides
 - ✓ Rotate to jobs using different muscle groups *



Building an MSD Solutions Program



Augmenters

The essence of an MSD
Solutions Program

Building

Foundation

MSD Solutions Lab

June 2021, NSC and Amazon announced a 5-year partnership to address MSDs, the largest category of workplace injuries in the US and globally.

Led by NSC and powered by Amazon, this initiative aims to prevent MSDs across all industries. It will do this by engaging key stakeholders, conducting research, inventing new technology and processes, and scaling the results. Five key components of this initiative are:

- ✓ Advisory Council
- ✓ Pioneering Research
- ✓ Small Business and University Grants
- ✓ Innovation Challenges
- ✓ Industry Call to Action – **The MSD Solutions Business Pledge**

Questions

Discussion

Thank you for joining us today!

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