

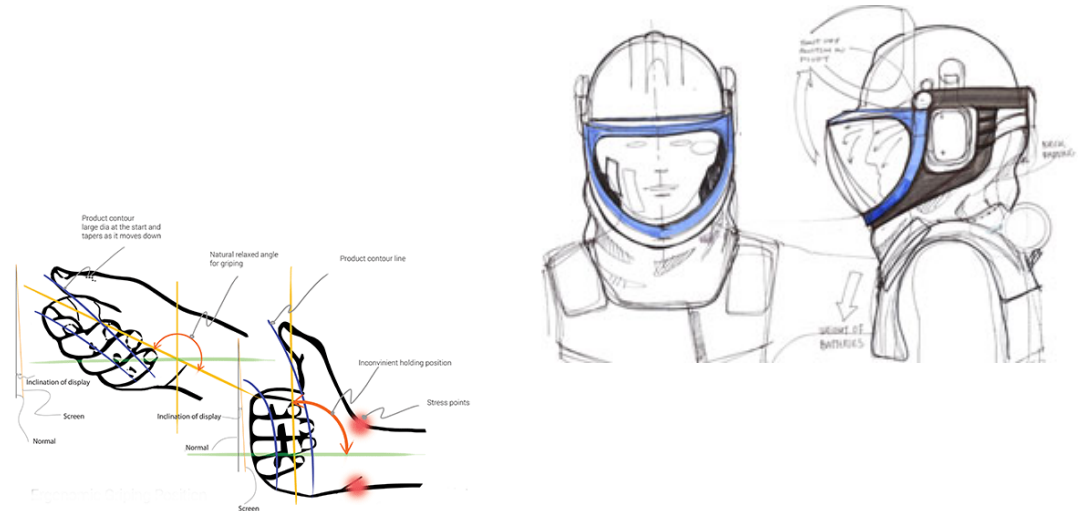
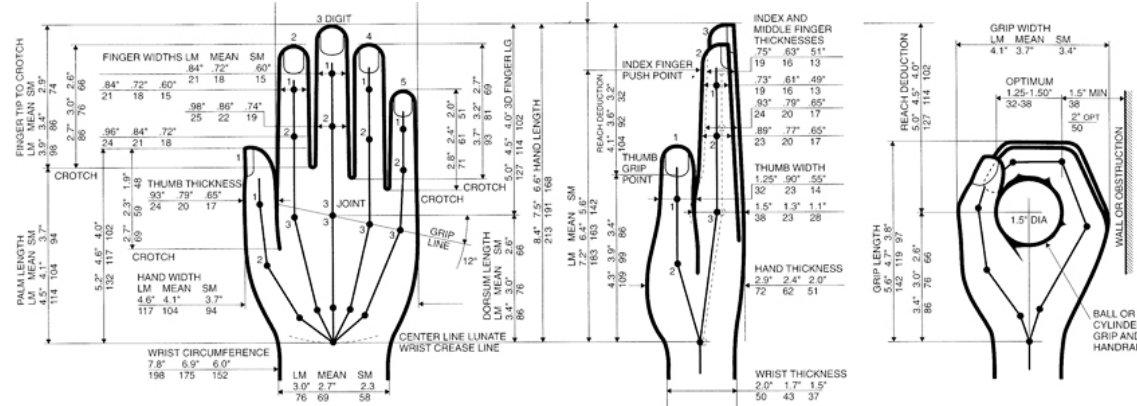
Ergonomic Yokes and MT Field Inspection

Llog NDT Conference 2019

David Geis



Ergonomics
for the home office.



Ergonomic Strategy

Reactive

- Long-standing procedures
 - “If it isn’t broke, don’t fix it!”
- Escalating stress on workers
 - More breaks required
 - Increasing complaints and inattention
 - Higher turnover and absenteeism
- Near-miss or recordable events
 - Injury means lost time, medical expenses and Workers’ Comp costs
 - Modify procedures or substitute equipment to prevent another incident

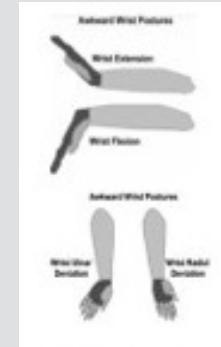
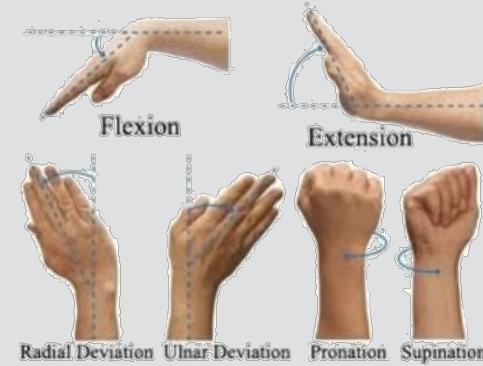
Proactive

- Evaluate each job function
 - Observe tasks and effort required
 - Rate as low / medium / high risk
- Implement changes
 - Prioritize high risk tasks
- Reduced stress on workers
 - Fewer breaks required
 - Lower turnover and absenteeism
 - Higher productivity
 - Fewer near-misses or recordable events

Risk Factors



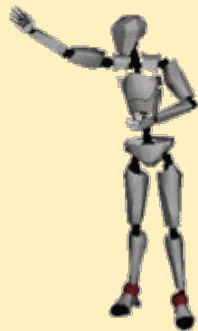
Lifting & Carrying



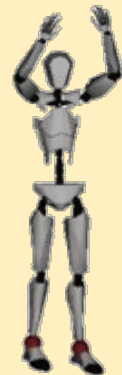
Wrist Deviation



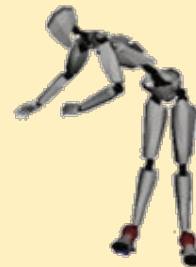
Posture



Reaching



Overhead



Outstretched



Hunched



Bending



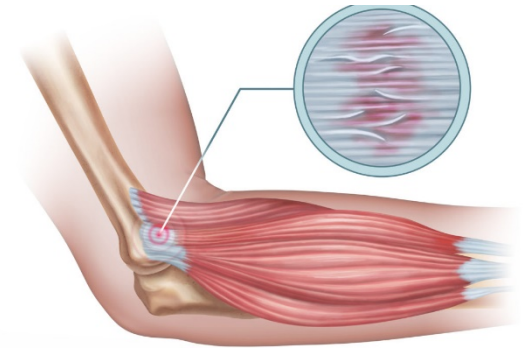
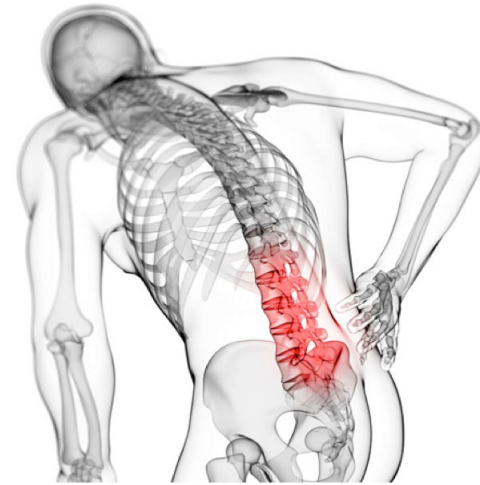
Squatting



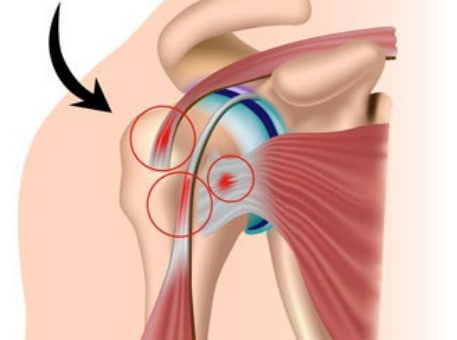
Kneeling

Musculoskeletal Disorders (MSD)

- Lower Back Strain
- Neck Strain
- Herniated / Ruptured Discs
- Carpal-Tunnel Syndrome
- Wrist Tendinitis
- Elbow Strain (Epicondylitis)
- Shoulder / Rotator Cuff Injury



Inflamed/torn tendons

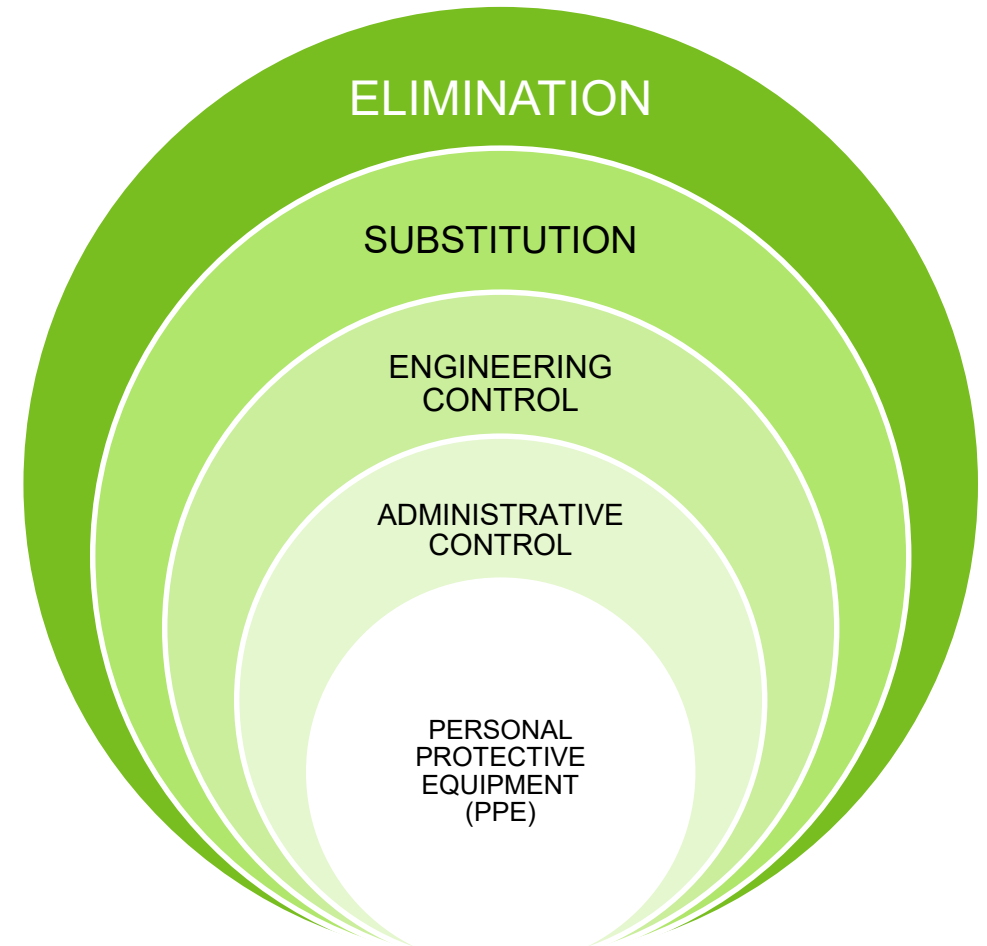


Tasks with High Risk Factors



Risk Reduction

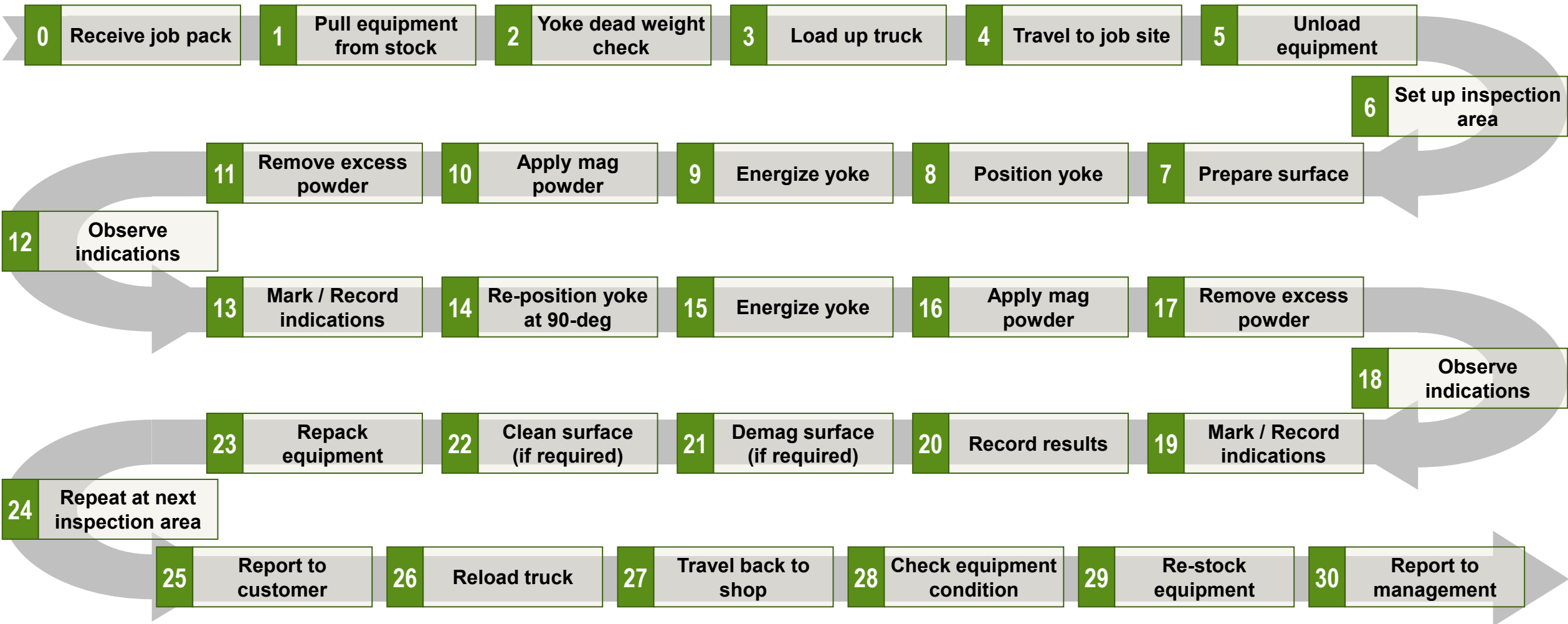
1. **PPE:** minimize the effect of the hazard
2. **Administrative Control:** minimize number of people exposed to hazard
3. **Engineering Control:** isolate people from the hazard
4. **Substitution:** reduce hazard level through replacement
5. **Elimination:** completely remove the hazard



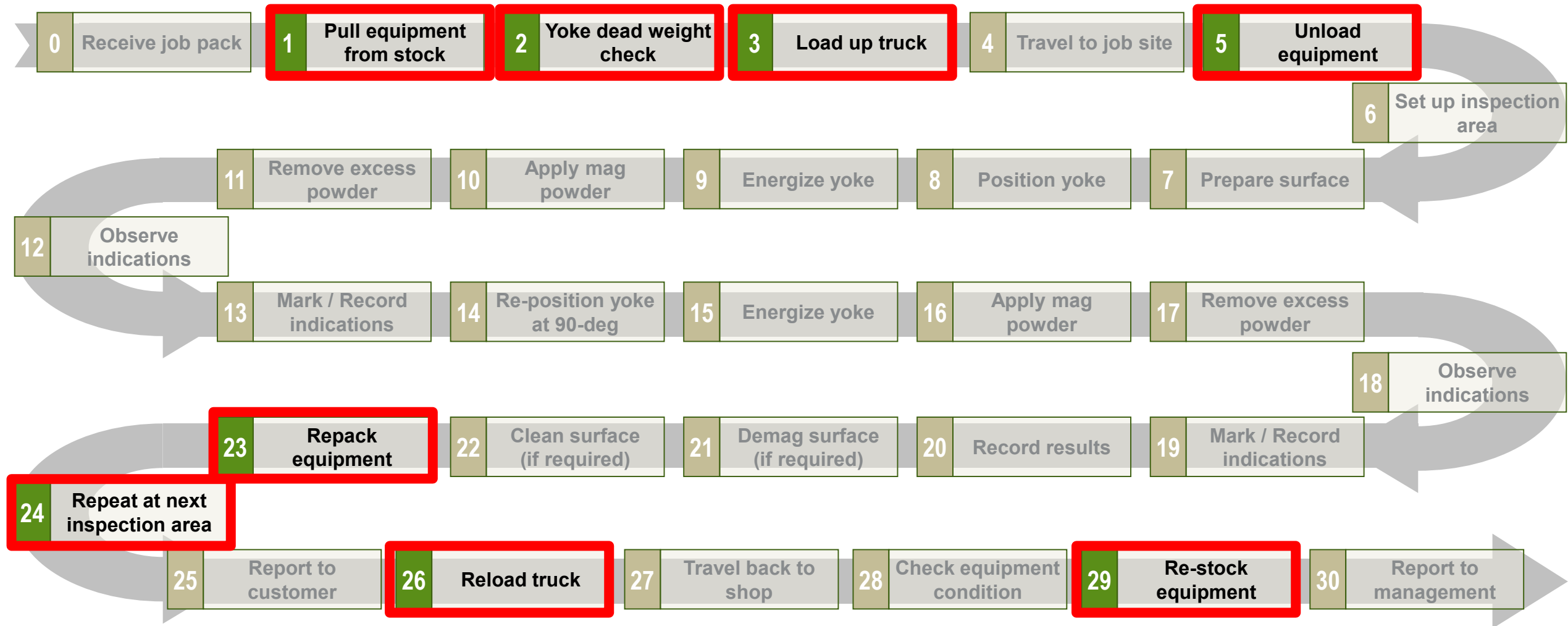
MT Field Inspection



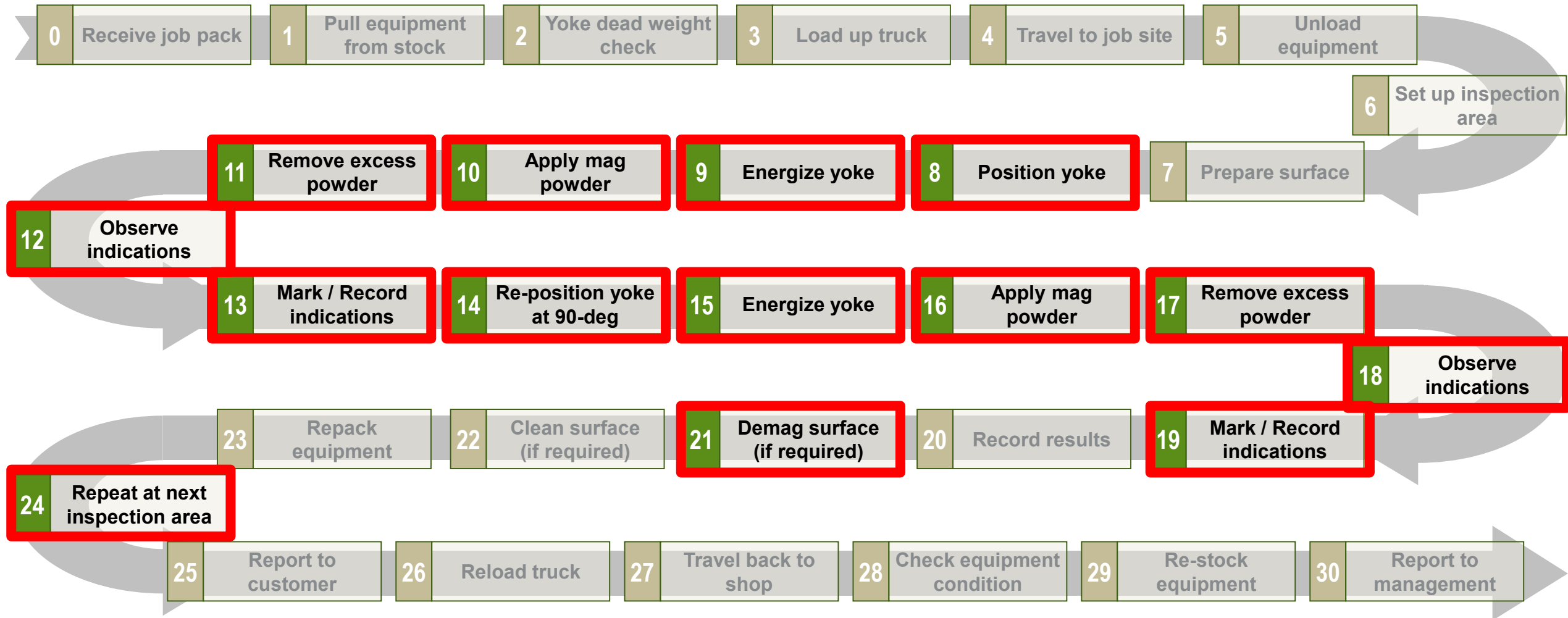
Field Inspection Process



26% of Process has **Lifting & Carrying Risks**



46% of Process has Awkward Posture Risks



Awkward Posture Risk Reduction



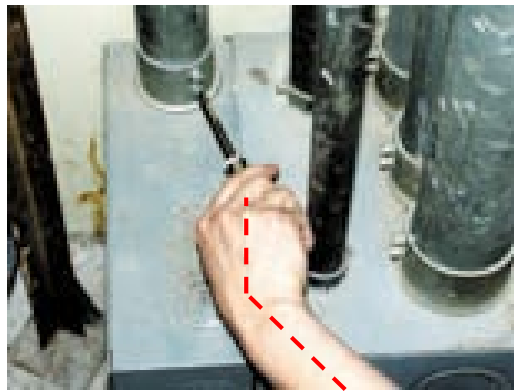
53% of Process has Wrist Deviation Risks



Wrist Deviation Risk Reduction

Positioning

- To minimize risk, minimize wrist deviation
- Use power grip for high force tasks



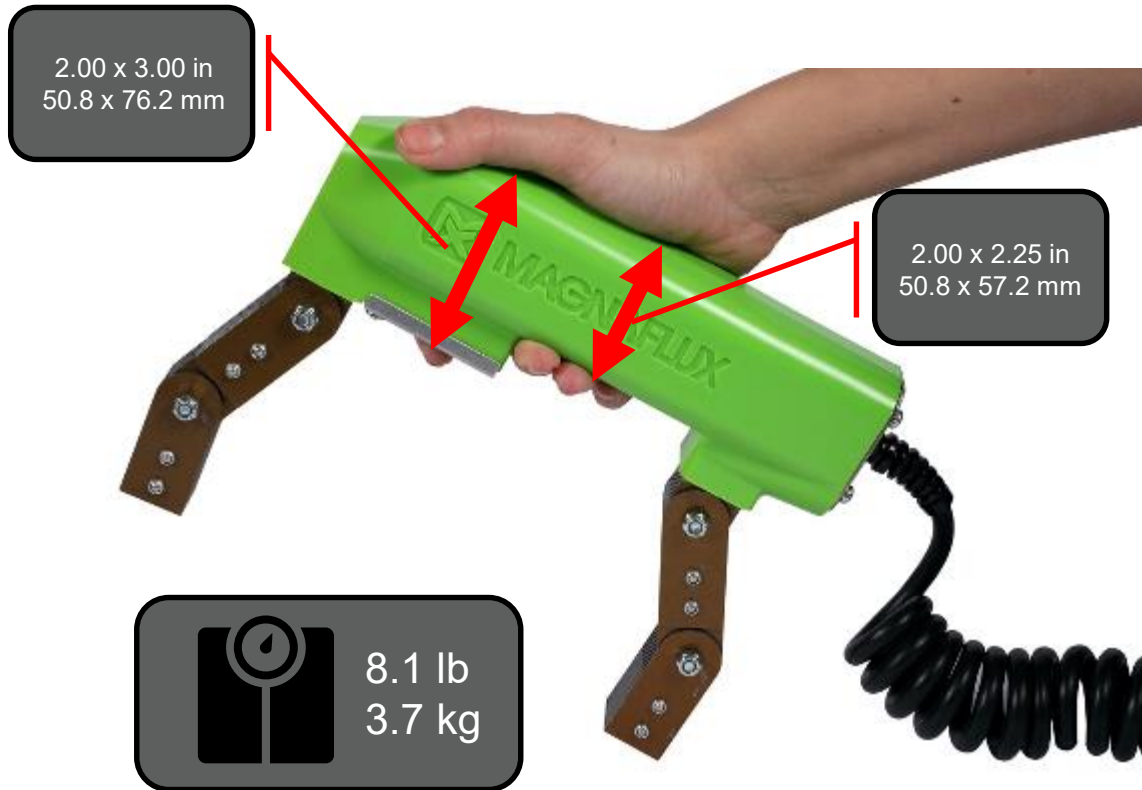
Tool Design

- The right handle size and contour will minimize wrist deviation
- Less effort required, lower risk

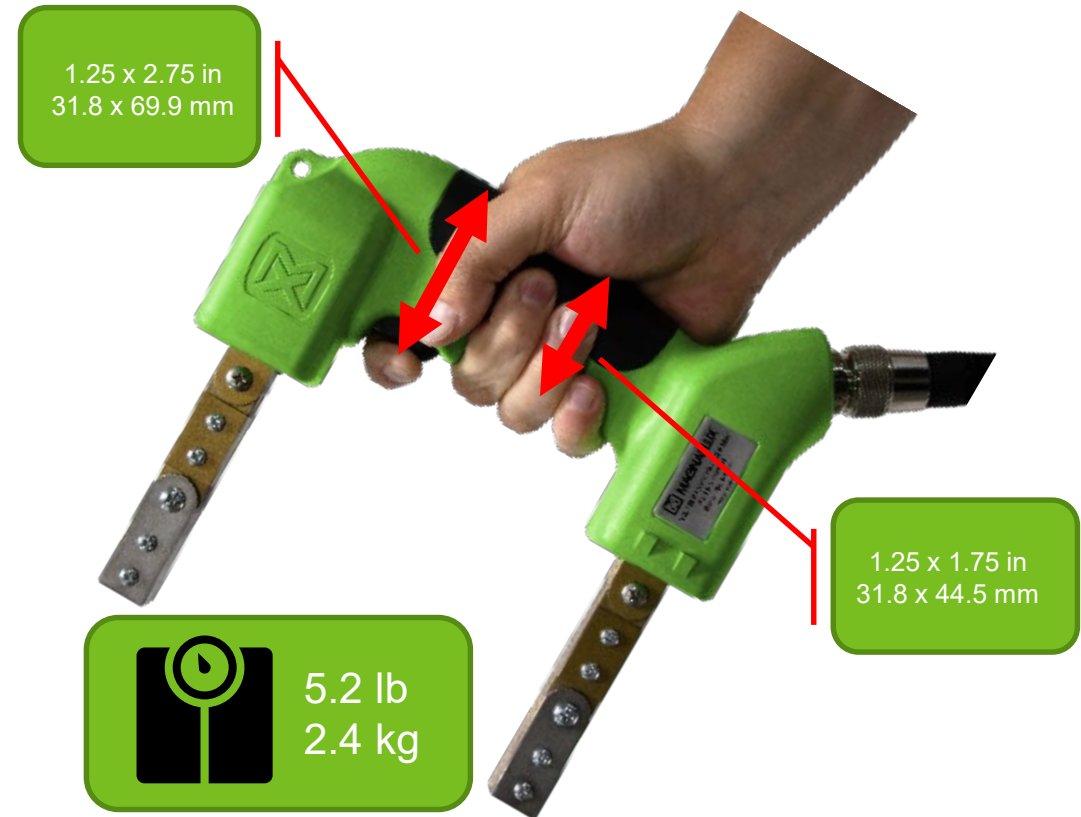


Ergonomic Design

Standard Yoke



Ergonomic Yoke



Ergonomic Impact

- Yoke held in position with arm extended 16 in / 40 cm away from body
 - Standard Yoke
 - 2.7 in / 69 mm diameter handle
 - 3.2 in / 81 mm diameter trigger
 - 10.8 ft-lb / 14.5 N-m torque
 - Contoured Yoke
 - 1.9 in / 49 mm diameter handle
 - 2.6 in / 65 mm diameter trigger
 - 6.9 ft-lb / 9.4 N-m torque
- 36% less effort required
- Task completed 5% faster on average



Rugged Field Durability



- ✓ Modular power cord
- ✓ Molded O-ring seal
- ✓ Isolated trigger chamber with sealed switch
- ✓ Impact-resistant LED yoke light
- ✓ Snap-fit yoke light

Operating Costs

- Typical MT Field Inspection
 - 250 work days per year
 - Excluding weekends & holidays
 - Subtract administrative, safety training, job training, vacation, sick days, etc.
 - Net 120 active inspection days per year
 - 8 hour work day
 - Subtract load/unload time, travel time, setup, breaks, reporting, cleanup, etc.
 - Net 4 hours of active inspection per day
 - $(120 \text{ d/y}) \times (4 \text{ hr/d}) = 480$ active inspection hours per year
- Annual inspection labor costs
 - \$50/hr fully burdened labor rate
 - $(480 \text{ hr/yr}) \times (\$50/\text{hr}) = \$24\text{k}$ labor per year per inspector

Ergonomic Savings

- **Inspections can be completed faster**
 - Average 5% time savings during inspection
 - $(5\%) \times (4 \text{ hr/d}) \times (120 \text{ d/yr}) = 24$ additional inspection hours per year
- **Reduced operator stress and strain**
 - Average 3 work days reclaimed from burnout or absenteeism
 - Average 1 work days reclaimed from doctor visits, sick days or medical leave
 - $(4 \text{ hr/d}) \times (4 \text{ d/yr}) = 16$ additional inspection hours per year
- **Reduced medical expenses**
 - Fewer medical claims reduces the risk classification for group insurance
 - Avoid 1 reportable incident with injury

Durability Savings

- **Outside repair service eliminated**
 - Damaged cords can be swapped out
 - Switch repair does not require disassembly
 - Damage requiring service 1x / yr
 - Service center labor rate \$150 / hr
 - Shipping to/from service center \$25 / yoke
 - Inside repair labor rate \$25 / hr
 - $(150) + (25) - (25) = \$150$ net savings per year

Return on Investment

- Baseline
 - 480 inspection hours per year
 - \$24k labor cost per inspector per year
 - \$175 repair cost per yoke per year
- Investment
 - \$775 per ergonomic yoke per inspector
- Savings
 - 40 inspection hours reclaimed
 - 8% productivity gain = \$2,000 per inspector per year
 - \$150 savings from inside repair vs. service center
- Return
 - 167% ROI after tax, <6 months payback
 - Not including medical or insurance savings

References

NIOSH 2013-111: “Simple Solutions for Home Building Workers”

OSHA 3341-03N: “Guidelines for Shipyards” (2008)

NIOSH 2007-122: “Simple Solutions – Ergonomics for Construction Workers”

NIOSH 2004-164: “Guide to Selecting Non-Powered Hand Tools”

NIOSH 2000-170: “Shipyard Ergonomics Project Workshop”

NIOSH 95-114: “Strategy for Industrial Power Hand Tool Ergonomic Research – Design, Selection, Installation, and Use in Automotive Manufacturing”



Thank You!