

# The 3E Process to Eliminating Musculoskeletal Injuries: *Engineering, Ergonomics, and Exercise*

Jon Kabance, RKT

# About the Speaker

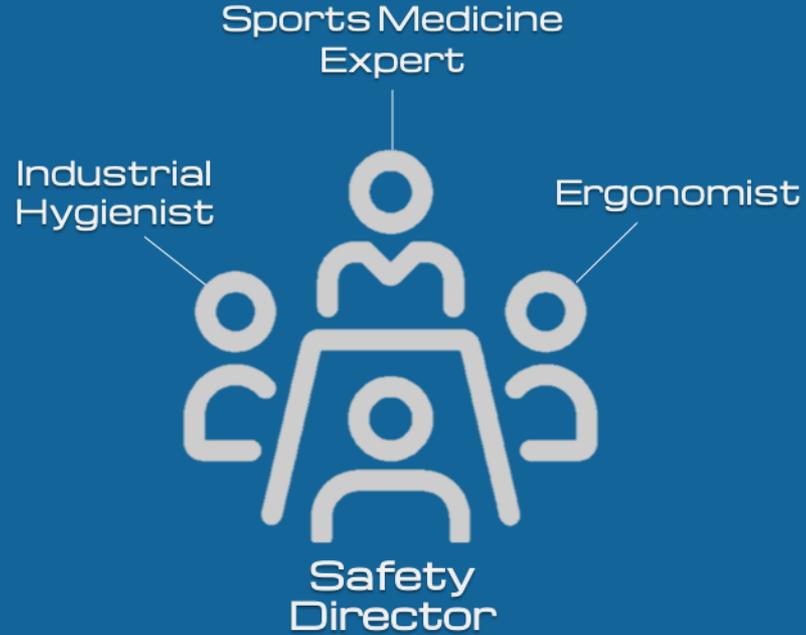


**Jon Kabance, RKT**  
BIOKINETIX President

As a registered Kinesiotherapist and President of BIOKINETIX, Jon has been masterful in combining his expertise in sports medicine and education with the real-world demands companies face every day.

Jon's thought leadership has helped clients save over \$100 million through strategic prevention and wellness solutions.

# Today's Occupational Safety Team



Client sampling:  
Who's benefiting from The Science of More UpTime?



DTE Energy®



Partner sampling:  
Some of our broker partners



Results:  
What you can expect

**\$1 / \$5.62**

**Average ROI Ratio**

For every **\$1** invested in BLOKINETIX programs, our clients experience an average savings of **\$5.62** on workers' comp and other related costs.

# The BLOKINETIX Difference



## **Proactive— focus on prevention**

BLOKINETIX has perfected a preventive approach that ensures the effectiveness and long-term viability of our programs.



## **Sports medicine, exercise-based best practices**

For over a decade, BLOKINETIX has been advocating prevention through applying sports medicine principles in the workplace setting. These occupational health programs are designed to address the industrial athlete with the same preventive strategies found in professional sports.



ENGINEERING  
ERGONOMICS  
EXERCISE



ENGINEERING  
ERGONOMICS  
EXERCISE

## 1. Engineering

- Optimal intervention to eliminate all risks of injuries
- Create, improve, or redesign a tool or piece of equipment
- Adapt a job description or develop a safety policy based on physical demands

*If engineering is cost-prohibitive or impractical, we shift to Ergonomics*



## 2. Ergonomics

- Evaluate all job functions and job tasks for at-risk behaviors
- Develop best-practice ergonomic methods to mitigate risk at each level
- Instruct employees in avoiding at-risk movements and enhancing fluid body mechanics
- A medical ergonomics approach that uses anatomy, physiology, and body mechanics to train workers to complete job tasks safely

*If ergonomics cannot fully mitigate injury risk, we shift to Exercise*



ENGINEERING  
ERGONOMICS  
EXERCISE

### 3. Exercise

- Time-efficient interventions designed to prepare the body for the physical demands of job tasks
- Properly warm up the body before beginning job tasks
- Reset the body after repetitive movements
- Develop personalized strength & conditioning programs

# Exercise Modality Matters

## Going *beyond* passive stretching programs

Exercise interventions have great value from a behavioral standpoint, but this value is derived from the effectiveness of the activity on a physiological level.

In order to successfully reduce sprains, strains and other soft-tissue injuries, the exercise modality must improve function **on the soft tissue level**.

- ✓ Exercise is an incredibly effective method of physiological preparation and conditioning because:
  - ✓ Increases soft-tissue capacity
  - ✓ Increases soft-tissue resilience
  - ✓ Increases soft tissue's ability to repair & recover



# Why *On-Site* Exercise?

*Exercising in the workplace has the greatest potential to maximize employee performance and increase engagement.*

A 2015 analysis of 61 studies identified and assessed 30 unique workplace intervention types in the prevention of upper-extremity MSDs:

- Out of all categories, **resistance exercise** showed the strongest evidence of effectiveness
- Study authors concluded that “implementing a workplace-based resistance training exercise program can help prevent and manage UEMSD and symptoms.”

A 2015 randomized controlled trial compared the effects of work-based vs. home-based exercise on work ability. The work-based group demonstrated:

- Greater program adherence
- Reduced average pain intensity in neck, shoulder, and lower back
- Decreased number of sickness absences
- Improved ability to perform job tasks
- Increased muscle strength



# Exercise and the Aging Workforce

- **By 2024, 25% of U.S. workers will be age 55+**
- **While accident frequency decreases with age, injury severity and fatality increase**
- **Exercise is one of the most significant modifiable variables proven to improve the functional ability of an aging population**

## Warming Up

Risk: Higher vulnerability to slips, trips, and falls.

Warming up helps proactively mitigate the physical changes of aging, including reduced ligament elasticity and bone density.

## Strength & Conditioning

Risk: Progressive loss of muscle tissue & fiber, which places stress on the joints.

Strength & conditioning helps aging workers reduce and/or delay the loss of muscle mass.

## Resetting

Risk: More likely to need hospitalization after an injury, experience fractures, & have slower recovery times.

Resetting after repetitive job tasks helps reduce the likelihood & severity of recurrent injuries.



## Assessment Types

# 3E Analysis

Analysis of all potential job functions performed by employees, including:

- Measuring the biomechanical and physiological demands of specific job tasks
- Identifying engineering enhancements
- Developing best-practice ergonomic methods for performing job tasks
- Determining when pre-task and post-task exercise are optimal solutions to mitigate risk of injury

Benefits include:

- Reduces the physical stress of your employees
- Customized injury prevention programs specific to job tasks
- Utilizes data-driven insights to create improved job descriptions and proactive educational topics



# At-Risk Behavior Intervention



*Observe and track work performed on job sites to provide body mechanics coaching & mitigate at-risk behavior*

After identifying any at-risk behavior or body positioning, provide employees feedback in real time by:

1. Demonstrating correct behavior
2. Guiding employee to perform correct behavior
3. Validating that these corrections are applied to job task

Benefits include:

- Mitigating the risk of injury in real time
- Creating improved employee awareness of proper body positioning & safety techniques
- Can be used to identify trends in at-risk behaviors

ABI Report - Plant Scherer - Chemical Lab - Polishing Water

**TASK TITLE: Emptying Product Into Mixing Tank**

Observed Behavior(s)	Not At-Risk?	At-Risk?	At-Risk Trigger(s)	At-Risk Body Part(s)
Lifting a 30lb bucket with one hand consistently over an extended period of time (picture 1).		X	Repetition	Back, Shoulder, Wrist
Proper lifting technique. Employee bends back at hips and knees. Squared with bucket while lifting, using both hands in his power zone (picture 2).	X			
Employee bends low to lift bags (picture 3).		X	Repetition, Awkward Posture	Back, Shoulder, Wrist

1  2  3 

**Mitigation Recommendations**

**E1: Engineering**

- Build elevated platform with a shoot to sit the 30lb bag on before emptying into mixing tank. Shoot would prevent employee from bending over the top of the tank.

**E2: Ergonomics**

- Education on utilizing the hip hinge when lifting.
- Education on square and pivot to avoid twisting.

**E3: Exercise**

- 3 - Minute Warm - Up Program to prepare body for work and reverse effects of repetitive movements.
- Upright Rows to improve on upper back strength to reduce affects of repetitive stress of job task (Picture 1).
- Single Leg Squats to improve strength and improve proprioception of lower extremity (Picture 2).



# Leading Indicators: *ABIs*

## % At-Risk: Primary Triggers & Body Parts

**% At-Risk**

**84%**

**Awkward Posture**

**74%**

**Shoulder**

**51%**

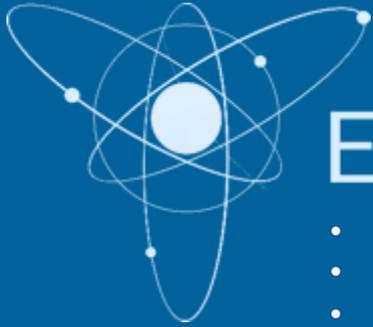
TESTIMONIAL

**Mark C.**

*Georgia Pacific  
Pulp Mill  
34 years*



"The BIKINETIX program is a huge benefit to employees here. I recommend these services to anyone who hasn't worked with Audrey yet. She's helped immeasurably with my own wrist and arm discomfort. I love the suction cups. After using them I feel great. She also brought a mat, foam roller, and education for us to use in the control room. I just can't say enough about this great program."



# ENGINEERING

- Tool Carts
- Pneumatic Clippers
- 24/7 Use Chairs
- Grip—All
- Anti-Fatigue/Ergo Mats

# Pneumatic Clippers

- Suspend – Reduce force required to maneuver clippers, additionally reduce stress on upper extremities during repetitive operation
- Stalk – Reduce stress from repetitive ulnar deviation + weight of clippers



# Tool Carts

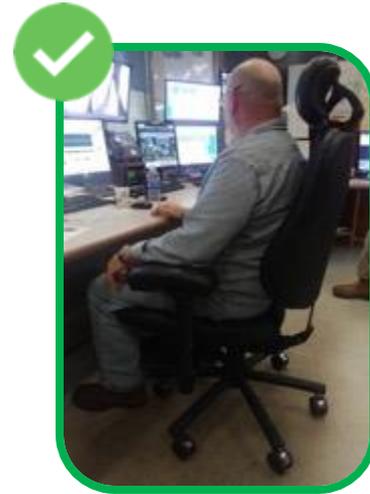
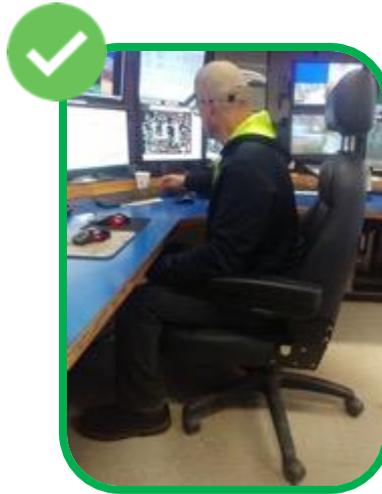
- Handle Height – Waist to elbow
  - Too Low - Contributes to spinal flexion & scapular protraction,
  - Too high - Overwork muscles of the upper back & shoulders
- Handle Orientation – Vertical vs Horizontal
  - Vertical handles reduce stress to the wrist/forearm and allow for increased generation of force
- Wheels – Pneumatic vs Solid
  - Personal preference/most frequently utilized surface
  - Pneumatic = more force to initially mobilize, but handle rough/uneven surfaces better



ENGINEERING

# 24/7 Use Chairs

- 24/7 operations require some operators to be present at monitors/station at least 80% of a 12 hour shift
- Standard office chairs - not built for 24/7 use
- 24/7 use - typically have long term warranties on replaceable components



ENGINEERING

# Grip-All

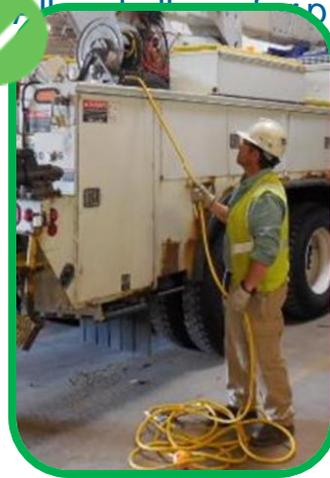
- Task: Retrieving grounding line
- **Old method: Using mobile equipment & vehicle**
- Manually pulling ground cable from cement requires OE to exert 39 pounds of force
- Using Grip-All to ground cable to rear of truck pinches shoulder structures and increases risk of forearm, wrist, & hand trauma



ENGINEERING

# Grip-All

- **New method: Using a retractable ground reel and cable**
- Reduces overall stress on body by automatically rewinding ground cable; the OE only has to exert 7 pounds of force to pull cable from reel
- Install attachment point at rear of passenger side box so that clamp end of ground cable is easy to access
- Eliminates need for G... for proper stabilization of right hand & wrist



ENGINEERING

# Anti-Fatigue / Ergo-Mats

- EE's must stand, kneel, sit or lay on firm or awkward surfaces when working on job tasks.
- Anti-Fatigue mats decreases the contact stress placed on the lower extremities.
- Grainger – NOTRAX Kneeling Pads & Anti-Fatigue Mats
- "I have had knee surgery in the past and when having to kneel down these have worked well in providing comfort."



ENGINEERING



# ERGONOMICS

- Avoiding the Impingement Zone
- Wrist Deviation
- Stairs
- 3 Points of Contact
- TA Activation
- Hip Hinge
- Scapular Retraction

# Body Mechanics

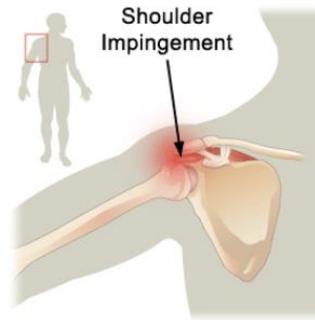
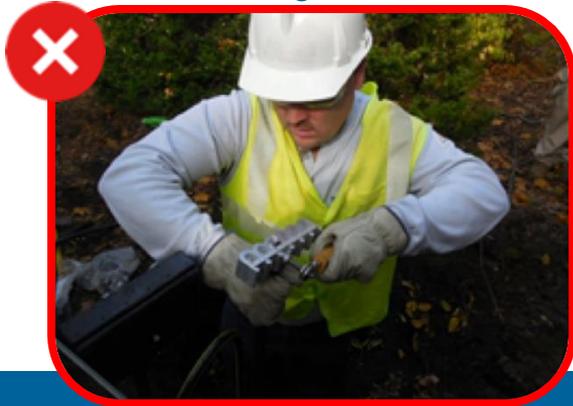
- Ever coached your child/grand-child from the stands or sideline? Why?
  - Better form = More power & efficacy
  - Better form = Less stress on the body's tissues
- Practiced – batting (elbow), free throw (elbow), football (hips), weight lifting (back/hips)
- Industry – Shoulder, wrist and knee position, scapular retraction, hinging at the hip, transverse abdominis activation,



# Avoiding the Impingement Zone

Job task: creating a line secondary main

- Repeated movement of the arms into the “Impingement Zone” (at or above shoulder height) compresses the shoulder tendons, nerves, and ligaments.
- Instead, a slightly lowered arm position prevents overload of the shoulder structures during manipulation of heavy cable.
- Use the elbow as a marker for proper arm position. For example: while bending the line secondary main and attaching it to the bus, the elbows should be lowered about 6” below the shoulder.

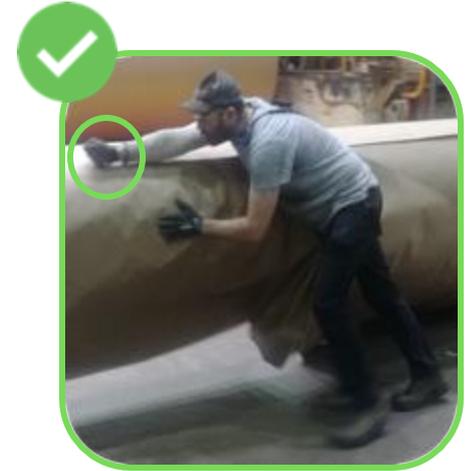
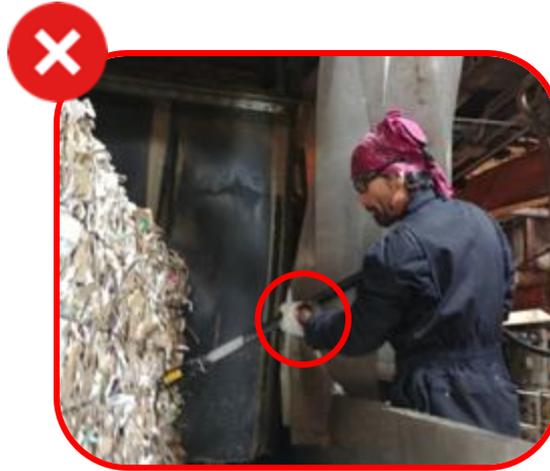
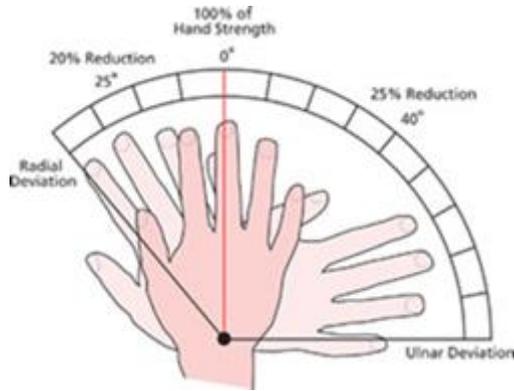


ERGONOMICS

# Wrist Deviation

Job tasks: pneumatic clipper use, slab remainder of paper reel

- Lose grip strength with deviation as well as repetitively impinge nerves and blood vessels of the wrist

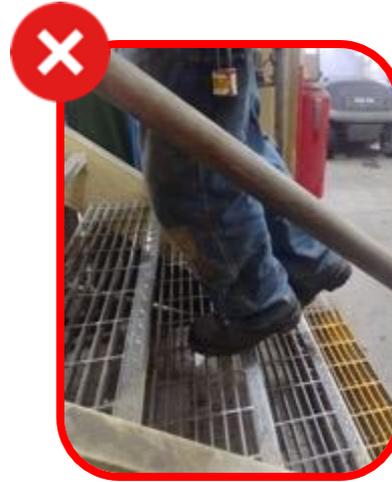


ERGONOMICS

# Stairs

## Job task: ascending stairs

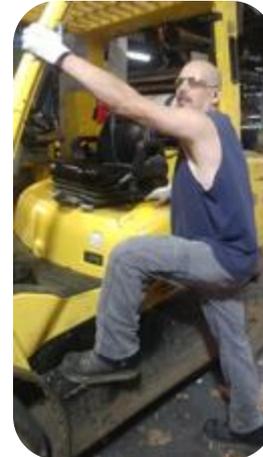
- Place entire heel on step
- Generate force from large posterior muscles rather than translating force to quadriceps and front of knee



# 3 Points of Contact

Job tasks: open/closure of rail car door, enter/exit mobile equipment

- Maintaining 3 points of contact when getting on and off mobile equipment
- Exiting rig when facing body outward greatly increases force translated to joints of the lower extremities



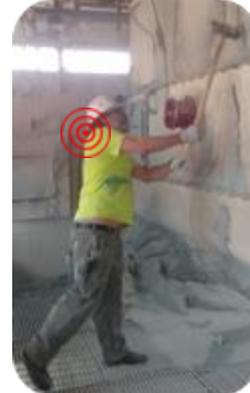
ERGONOMICS

# TA Activation

Transverse abdominus (TA):  
*Protects spine from rotational force & stress from spinal flexion*

Job tasks: utilize various sledgehammers, open/closure of rail car door, shovel work

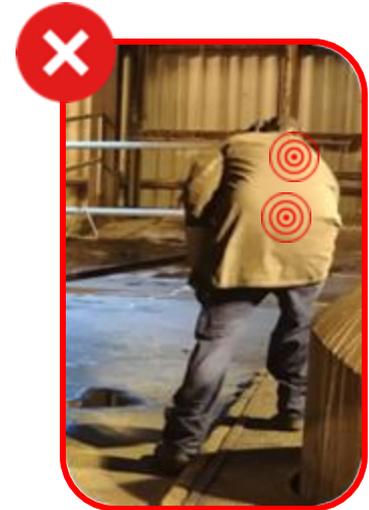
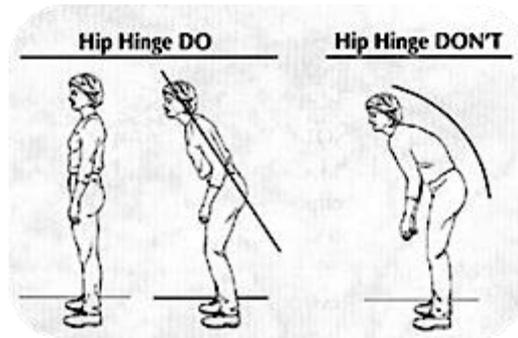
- Generate more force with less overall work and strain on the body



# Hip Hinge

Job tasks: rodding portholes, rodding smelt spouts

- Activate larger muscles = more power
- Avoid stressing the spine by hinging at the hips



ERGONOMICS

# Hip Hinge cont.

Job tasks: push equipment lifted on chain falls (1 & 2), low sitting work, shovel work, open/closure of rail car door

- More power!
- Avoid flexing the spine by hinging at the hips

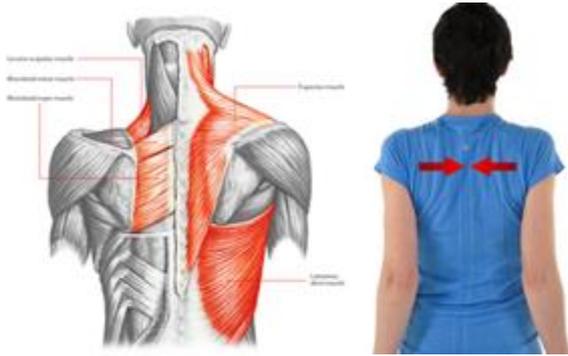


ERGONOMICS

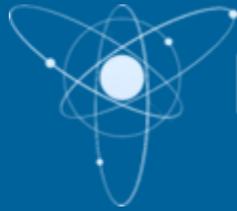
# Scapular Retraction

Job tasks: operate mobile equipment, hose down equipment, slab remainder of paper reel

- Recruit larger muscles of the back to generate more force AND stabilize the shoulder joint



ERGONOMICS



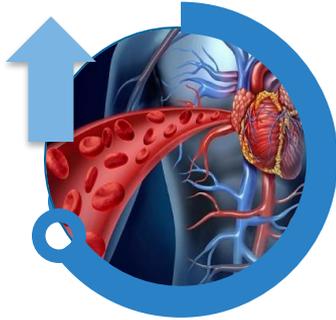
# EXERCISE

- Warm Up
- Reset
- Strength & Conditioning/Daily Mechanics
- Cool Down/Recover

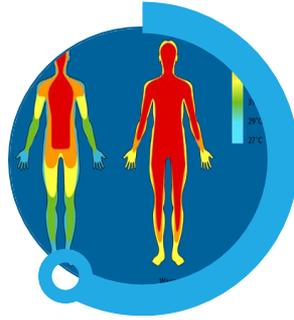
# Warming Up



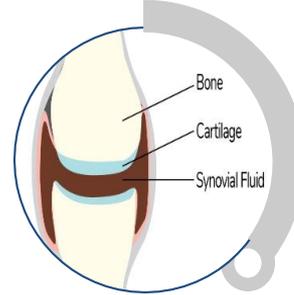
*A modern, sports medicine derived method that engages the muscles in movement and properly prepares the body for the physical demands of work.*



**Increases blood circulation**



**Increases body temperature**



**Prepares joints for movement**



**Improves balance & coordination**

# Leading Indicators: *Warm-Up Program*

## Average Proficiency\*

Upper Body

8.58

Max of 10

Lower Body

3.86

Max of 4

\*Assessed by grading the mastery of each movement of the upper and lower body warm up

## TESTIMONIAL



**John Huling**

**S**

*Forest Park  
Meterman  
32 years*

“Since BIODINAMIX implemented the 3-minute warm-up program, and I started doing my correctives, I have noticed that my leg cramps are gone. I use to wake up in the middle of the night with cramps and that is a horrible feeling. It is a great feeling not to have cramps any longer. The exercise is working for me.”

# Warm-Up Programs

Sports medicine has evolved from stretching the body to warming-up the body.

## BIOKINETIX 3-Minute Warm-Up

- A powerful, time-efficient method for preparing the body for work
- Task-specific moves
- Total body preparation
- Uses powerful resistance tools
- Promotes a positive cultural change

## Protects profitability and employee wellbeing by ...

- Properly preparing the body for job tasks prior to work
- Preventing knee, back and shoulder injuries
- Promoting a team atmosphere
- Promoting positive employee morale



# Warm-Up

## Neck, Upper Back & Shoulders, Forearms & Wrists

Neck circles



Arm circles



ITY



Throttle



EXERCISE

# Warm-Up

Knee Hug/High Knees



Torso, Low Back, Hips, Legs, & Ankles

Mini Warrior/Warrior 1



Hip Swings



Calf Raise



Step & Scoop



EXERCISE

# Resetting



*Activating the muscle groups opposite the ones being repetitively used to create symmetry*



**Helps combat repetitive stress of specialized job tasks**



**Creates symmetry in overused muscles & joints**



**Prevents poor posture**



**Improves manual dexterity**



**Increases physical resilience**

# Reset: Neck/Cervical Spine



Chin Tuck



EXERCISE

# Reset: Shoulders/Upper Back



Scap Squeeze



EXERCISE

# Reset: Chest/Upper Back



## Arm Scissors



EXERCISE

# Reset: Low Back/Hips



Mini Warrior



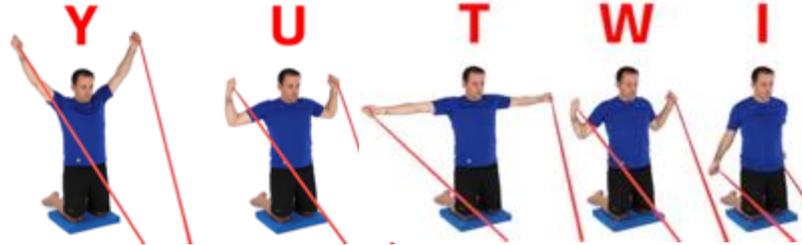
EXERCISE

# Strength & Conditioning/Daily Mechanics

Neck rotations



ITY/YMCA



Plank



Body Weight Squat



Balance



EXERCISE

# Annual Training Plan

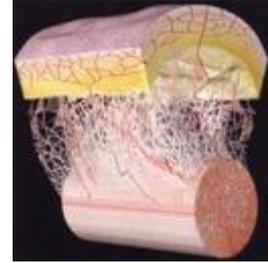
- Sport– Off-season, Preseason, In-season, Postseason
  - Revolves around the competition season/goal
- Broken down to achieve specific goals
  - Pre-season: Fine tune mechanics & team chemistry
  - In-season: Maintenance body & stress
  - Post season: Recovery & reflection
  - Off season: High intensity training & technical work
- Industry– Much revolves around annual outages & unplanned outages occurring throughout the rest of the year



# Recover: Cool Down or Foam Roll

## Foam Rolling = Self Massage, Aka Myofascial Release

- Myo = Muscle
- Fascia = connective tissue surrounding muscles, groups of muscles, blood vessels, and nerves
  - Binding some structures, while permitting others to glide smoothly over each other
- Use a foam roller for chronic muscle aches, post workout soreness/fatigue, and muscle strains!



# Program Results

# Client Case Study

Data presented at ASSP Safety 2018 with UPS VP of Global Health & Safety, Alexi Carli



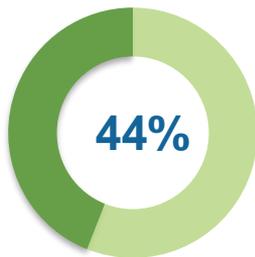
Workers' Comp  
Claims reduced



DART Rate  
reduced



Lost Time Rate  
reduced



Reduction in incurred  
dollar performance:



## Program Proficiency

Upper Body  
Overall Program Averages

8.42

(Max of 10)

Lower Body  
Overall Program Averages

3.53

(Max of 4)

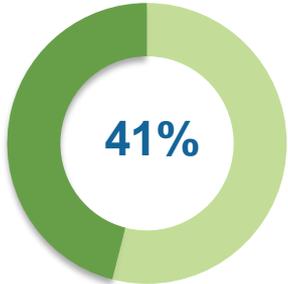
## Adherence Score:

91%

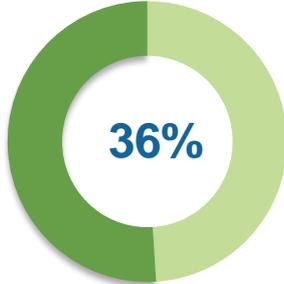
# Client Case Study



Total claims  
reduction



Total incident  
reduction



Total cost reduction



## Program Proficiency

Upper Body  
Overall Program Averages

8.65

(Max of 10)

Lower Body  
Overall Program Averages

3.61

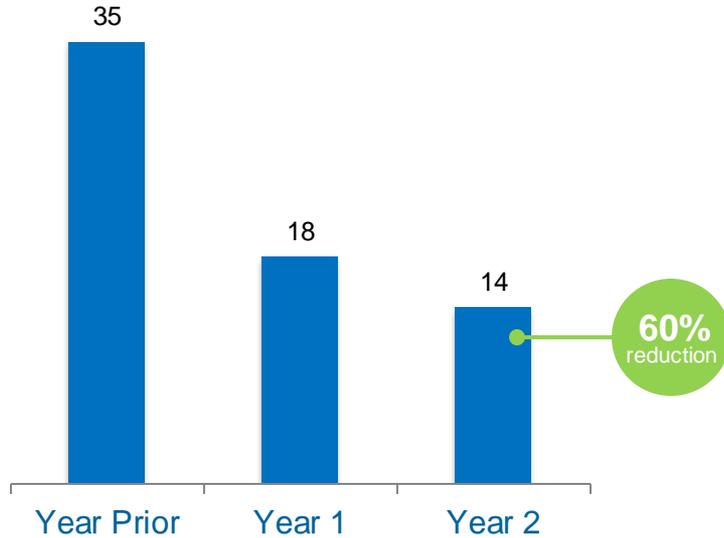
(Max of 4)

## Adherence Score:

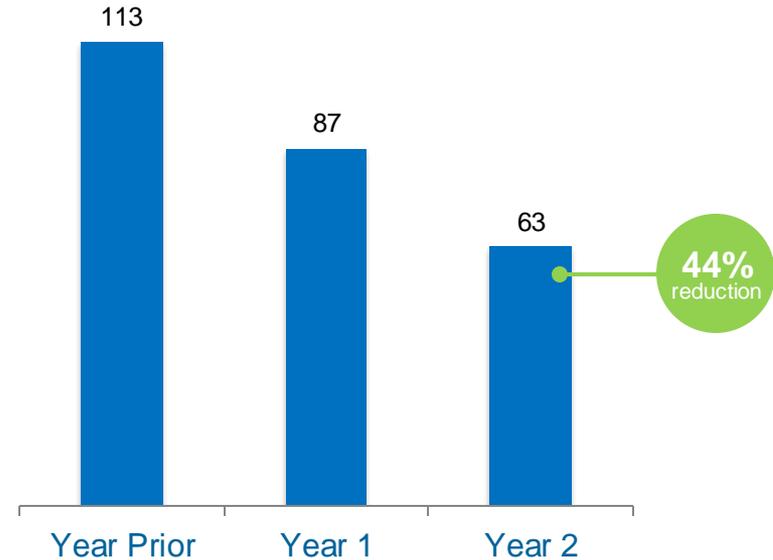
96.4%

# Client Case Study - Utility

OSHA-Recordable Strain, Sprain, Torn & Twist Injuries

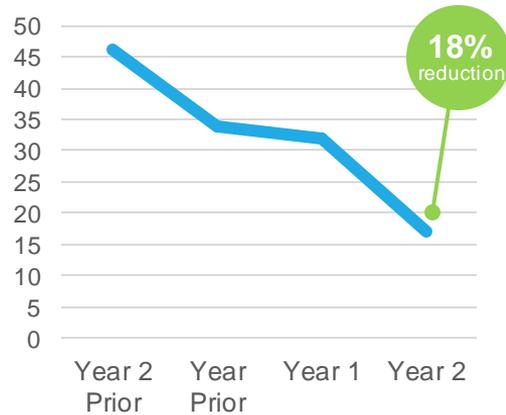


OSHA & Non-OSHA Recordable Strain, Sprain, Torn & Twist Injuries

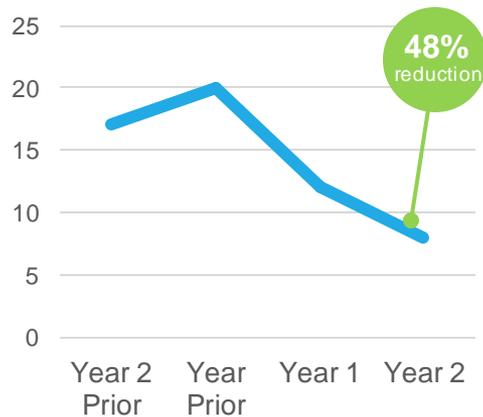


# Client Case Study - Utility

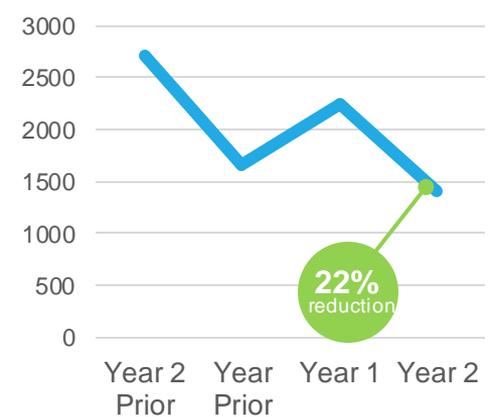
## OSHA-Recordable Injuries



## Strain & Sprain Injuries



## Number of Lost Days



# Client Case Study

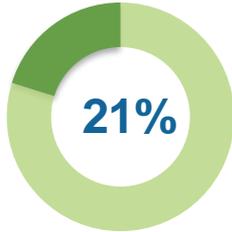
350-employee facility



Workers' Comp  
Claims reduced



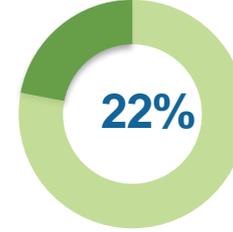
Injury Recordable  
Rate reduced



Lost Time Rate  
reduced



Restricted Days  
reduced



**\$322,864  
saved**

## Quantifiable results.

Implementing BIODINETIX Injury Prevention Programs saved Pepsi Americas \$322,864 in overall reduced costs related to workplace injuries and illnesses.

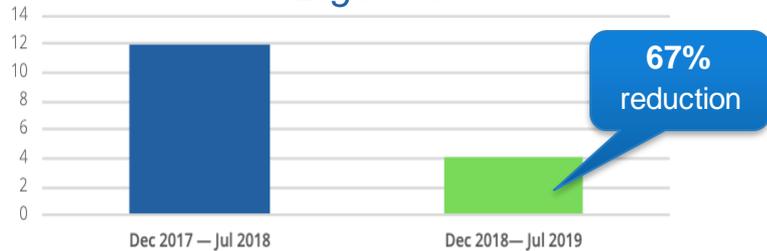
# Client Case Study



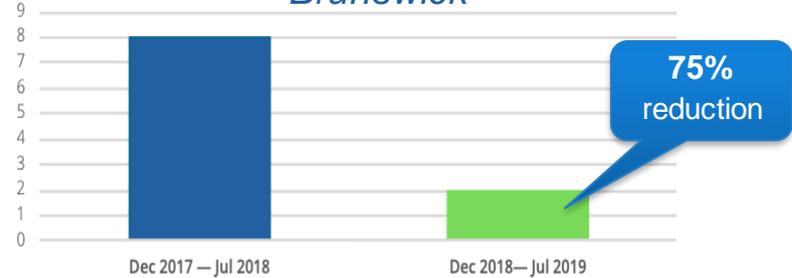
**Georgia-Pacific**

## Recordable Musculoskeletal Injury Reduction by Site

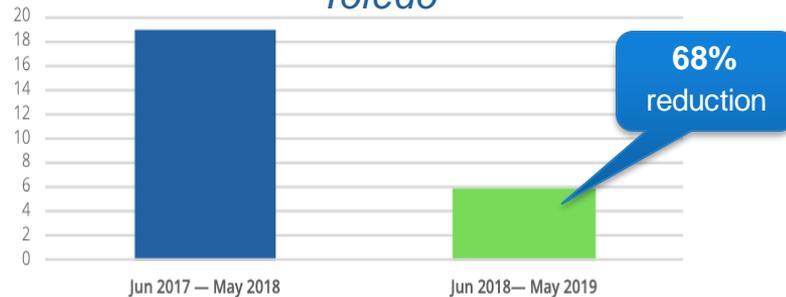
*Big Island*



*Brunswick*



*Toledo*



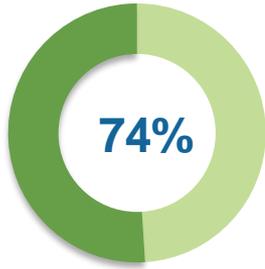
# Client Case Study



Workers' Comp  
Claims reduction



DART Rate  
reduction

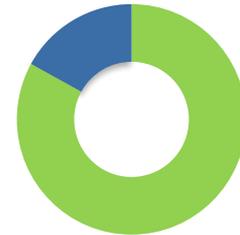


Lost Time Rate  
reduction

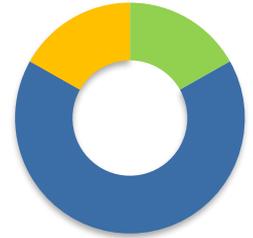


## Program Proficiency

Lower Body  
Overall Program Averages



Upper Body  
Overall Program Averages



- Excellent
- Good
- Fair
- Poor

## Adherence Score:

95%

# Additional Client Results



Client: **ADM**

Continuous days without an OSHA recordable:

814+



Client: **Del Monte**

Average cost per claim reduced by 37.5%

Average time to close claim reduced by 32.5%



Client: **Vienna Beef**

380-employee facility

Reduction in soft-tissue injuries:

38%

# Employee Testimonials

Dave Wilder



Maintenance | 5 years

“As part of the SET, and the group that lobbied to get professional help on-site to help with the soft tissue concerns, I’m grateful the company sees the value in the BLOKINETIX Program. Recently Audrey has kept me out of the doctor’s office twice. First with a shoulder problem and more recently a hip issue. Years of abuse to my body through working brought me to a point where many simple functions have been painful or nearly impossible. For years now it’s been painful to even bend over to pick something small up off the floor because of my hips. With consistent warm-up and stretching exercises that she’s provided I’m able to be better prepared for work. Though the one-on-one time with Audrey, being stretched and massage, is what I think is really improving my pain level and overall mobility. Thus my quality of life is much better. I can’t say enough about the care I’ve received and hope that others do the same.”

Brian Lorimor



Paper Production/MGMT | 8 years

“Having a resource on site, like BLOKINETIX, has proven beneficial. I have been dealing with what I thought to be a strain/tendinitis in my forearm. Audrey has been giving me cup therapy, recommended exercises, and applies k-tape to the area. I’ve noticed a decrease in nagging pain and my overall use of my left arm has increased. I’ve recommended BLOKINETIX to all of my employees and coworkers, we all need to take advantage of these services.”

Jay Hadley



Pulp Production | 14 years

“I was leaving the mill and thought to myself, I don’t know the last time I walked out of here without limping! Thanks to your recommendations my knee is feeling much better!”

# Employee Testimonials

Chris Hamilton



Bleach Plant | 26 years

“Ariana has been a nice help with my understanding of herbs, vitamins, and natural remedies for inflammation that can help improve my overall health. I can already feel some of the benefits of the ones we’ve discussed that I began taking. She has also taught me several exercises that have helped and pretty much eliminated my mild back discomfort that I was having. After talking with her and understanding more about the how and why I would get discomfort, I was able to use the techniques that she taught me to stay pain free. I find her an asset to our workplace to help educate everyone on the “how and why”, and the ways we can fix physical issues without just treating the symptoms with medication. Ariana also makes regular rounds to check on progress and to see if anyone has any questions or new issues, which I am thankful for because at times I am too busy to make it to her office. BOKINETIX is invaluable at an industrial workplace such as ours.”

Mike Outler



Bleach Plant | 11 years

“I didn’t realize how valuable BOKINETIX and Ariana were to our health until I needed them. Recently I experienced an injury to my knee and was able to get a thorough evaluation done by her and we discovered an underlying issue with my muscles. Ariana got me on a program to educate me on self-care, but was also instrumental in applying a few therapy techniques in the office to alleviate discomfort and increase range of motion. I appreciate her willingness to work around my schedule and be available during non office hours. I truly believe she has the knowledge of a physical therapist and I appreciate her sincere concern.”

Kevin Kilpatrick

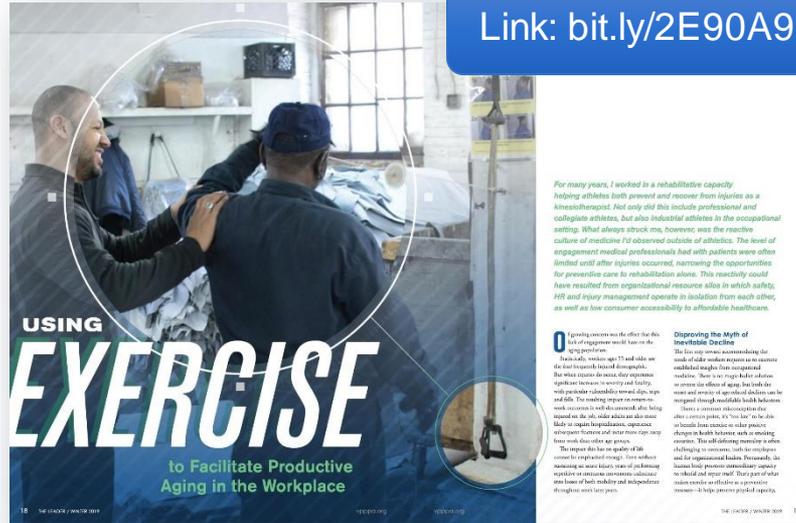


Lime Kiln | 19 years

“The information that Ariana provides us is highly important. She can observe and identify injury risk factors from the jobs that we perform. Ariana also shares her knowledge on nutrition, warm-ups, and self-care to provide preventative maintenance of our bodies. She has even given me things to do to help with my lower back discomfort which I have been doing daily. The biggest thing is that we all see her, and that we do not need to go out to find her. Ariana just does a great job of showing up, and being there for us.”

# For further insight into exercise as a means of **protecting your aging workforce**, read Jon's guest article in VPPPA's *The Leader*

Link: [bit.ly/2E90A9S](https://bit.ly/2E90A9S)



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