Ergonomic Tools Can Reduce Injuries and Improve Productivity

Ohio Gas Association
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Bruce K. Campbell

Why look at new tools and practices?

- Gas industry has an aging workforce (industry average is about 49 years old)
- Cumulative injuries, MSDs (Musculo-Skeletal Disorders), tend to show up when people are in their 40s
- Medical costs are still going up
- Injuries may be reduced if improved tools and practices are implemented

Lots of utilities have looked at this issue and have come to the same conclusion

- AGA major focus on safety and reducing injuries
- Utilities taking the initiative
- EPRI studies continuing

Two major approaches for improvement – Practices and Tools

Practices

- Stretching programs can be very effective
- Education about cumulative injury
- Training to use the tools correctly
- Changing what is done:
  - Horizontal Directional Drilling instead of Trenching
  - 18-inch Keyhole instead of a 4-foot Bellhole
  - Automatic Meter Reading instead of Meter Reading on foot

Two major approaches for improvement – Practices and Tools

Tools - Goal is to reduce the forces on the body, and improve body position to reduce injury incidence

The big six:

Wrenching	Barholing
Excavation and Restoration	Lifting and Loading
Slips Trips and Falls	Vehicle Design

Barholing / Drilling

- E-Z Drill
- Mining drill mounted on mini skid steer
- Hand held street drills
- Improved Plunger Bar
- Bar Puller – lever pulls probe bars out of the ground

EZ Drill field tested and used by several utilities

Drill Mate
and EZ-Drill
demonstration

AMS Subsurface Utility Prospector to be combined with a Ditch Witch Mini Skid steer. Drill tested successfully at Midwest utility – not available commercially yet.

9100 SUP using a 50 lb. rotary hammer for surface concrete removal. Test results: 3 holes drilled through 8 inches of concrete in average 1 minute 45 seconds.

Electric hand drills are an accepted option at several utilities, both corded and cordless, for street drilling.

TE 70-ATC Combihammer

Drilling range: 1/2" - 6".
Optimum drilling range: 7/8" - 1-3/4".
Active Torque Control provides added operator protection.

"The TE 30 Rotary Hammer Drill is lighter than the TE 70 ATC and can drill large diameter holes using the carbide core bits. We arrived at this solution when a number of women utility workers requested a smaller lighter tool."

TE 7-A CPC 36 V Li Rotary Hammer Drill

Drilling range: 3/16" - 1".
Optimum drilling range: 5/16" - 3/4".

The TE 7-A cordless rotary hammer drill provides impressive drilling power and range per battery charge provided by the new lithium-ion (li-Ion) standard.

One large utility recently decided to use the cordless Milwaukee V28 Rotary Hammer

New Plunger Bar improves arm position and grip

- Extended handles are angled towards the operator to minimize arm rotation and extension. “Anglefin”
- Smaller diameter for easier grip with gloves, small hands. Vibration isolation covers available (#113)
- 17 lb. and 13 lb. versions available:
    - Heavy duty #1000-4
    - Utility #1013-4

Heath Consultants and
Campbell Consulting

Bar Puller easily removes stuck probe bars

Kravitch Machine Company

Excavation/Restoration

- Jackhammer Lift Assist – pneumatic cylinder pushes jackhammer out of ground
- Manual Jackhammers – for small jobs instead of heavier air powered tools (street valve box covers)
- Air jet excavation instead of shovel
- Mud Shovel – clay doesn’t stick to head
- Small shovel – for tight spaces
- Backfill rake – easier and quicker than a shovel
- Ergo Tamp – reduced vibration for compaction

Jackhammer Lift Assist works for most hammers

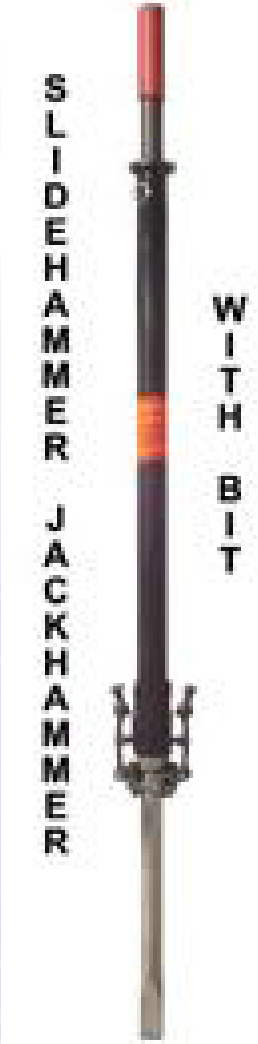
Reduces lifting strain when operating hammer

Manual Jackhammers are lighter weight than pneumatic hammer reducing strains and sprains.

BITTYBREAKER™

AJ Utility Hammer
24 lbs. and 16 lbs.

- Weighs 25 lbs. compared to 60 lbs.
- Safer than picks and digging bars.
- Excellent for small jackhammer jobs.
- Accepts any standard jackhammer bit.
- Great for exposing valve covers, CP test stations
- At least three manufacturers



Kravitch
Machine Co.

High pressure air excavation tools can help excavation in rocky or porous soils and avoid difficult shoveling

AIR-SPADE®

- Dielectric shaft and handle
- Supersonic nozzle
- Lightweight
- 45 degree nozzle and extensions

MBW Soil Pick ®

Mud and Clay Release Shovels reduces fatigue and strains. Increase productivity.

Mud and clay don’t stick to the “holey” shovel.

New stronger composite handles.

Digging in a trench can require awkward body position with high impact forces.

Small Shovel works in tight spaces around pipe

28 inches long

#470

Steel Backfill Rake is faster and easier than a shovel

Useful for pulling select fill or spoil back into a trench, moving gravel, Cold Patch asphalt, and cleaning up the street, or a grass lawn.

20” blade, 60” handle

Vibration Tamper for Compaction Isolates Operator with in-line Shock Absorber

Typical Tamper

Tool with Ergo-Tamp

Tool acceleration reduced from **30 or 40** m/sec^2 down to **10** m/sec^2

European Vibration standards: worker can use tamper with Ergo-Tamp for up to 80 minutes instead of just 8 minutes without it.

MBW

Wrenching

- Pipe Wrench Handle Extensions lower torque
- Utility designed dedicated meter wrenches
- Palm Grips – lower hand stresses, force
- Swench – Manual impact wrench reduce torque for Flanges – compressor stations
- Kneeling Pad Pants for Pipe Fitters, Meter Techs. improve body position
- Low Torque Squeeze-off tools– stay out of the ditch, lighter weight

Pipe Wrench Handle Extensions Reduce Force by 40%

Aluminum Pipe Wrench is pinned so it won't slip out

Aluminum bends before wrench breaks – "weak link"

High friction knurled handle provides grip when wet – lowers hand fatigue

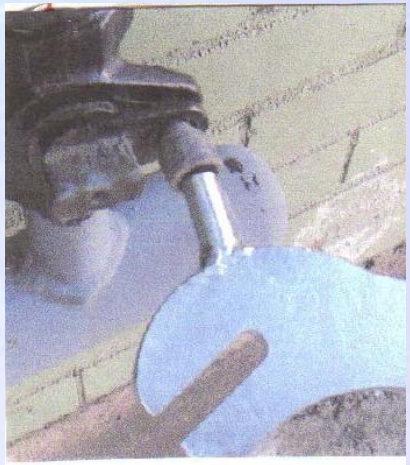
Dramatically reduces the force needed to break loose meter nuts – safer and lighter than a cheater bar

For 14" 18" and 24" wrenches – most common sizes

Original tool designed and tested by a utility - Ameren

Swivel Nut and HP Meter Valve Wrench

10 lt, 20 lt 30 lt, 45 lt, Sprague,
Meter swivel nuts



Key for Valve Lock

Howell Tool

Unicorn Valve
Wrench

Dimensions for Dedicated Swivel Nut Wrenches are critical

Swivel nuts are painted and rusted

Wrench for each size 10 lt., 20 lt., Sprague 1A, Pitts Emco, 30 lt., 45 lt.

Nisource prototype

Slip-on Palm grips lower hand forces, fatigue

These grips improve the ergonomics of hand tool use:

- reduce the hard surface contact with the palm of your hand,
- reduce the gripping force you need,
- make it easier to torque or twist the tool, and
- keep your hands away from the cold metal during outdoor use in the winter.

Three sizes fit a range of tool handles. Small has a contoured shape for easier gripping of small tools and the Medium and Large sizes are designed so 18” and 24” pipe wrenches still fit inside the aluminum pipe wrench handle extenders.

#105 #107 #109

Manual Impact Wrench great for loosening flange bolts

Best for compressor stations – hard to reach rusted flange bolts

You put in 150 ft. lb., it puts out 2000 ft. lb. of torque

(13:1 ratio)

The Model 1000 Impact Wrench is used for nut, bolt and anchor bolt driving and applying brute force to loosen frozen nuts instantly.

- Adjustable impact intensity.
- Maximum Pull on Handle: 75 Lbs.
- 2000 foot pounds of impact torque
- Square Drive Size: 1”
- Extremely portable compared to hydraulic, pneumatic or electrical applications.
- Weighs 23 lbs. 24 inches long

Swench – Power Hawk Technologies

Utility Work Pants with built-in knee pad pockets – great for pipe fitting, meter change-outs

- Allows better body position for wrenching, save your knees
- Hands free - Don't need to carry foam pad
- Ten specialty pockets for tools etc.
- 100% 12 oz. cotton canvas
- Pants come with free set of replaceable water proof knee pads, additional pads available
- Successfully field tested at Questar, Consumers, WE Energies, Nisource, Nicor, Alliant, Vectren, National Grid, National Fuel

Velcro pocket closure available #642

#632

Armed Workwear

Family of Squeeze-off Tools are lightweight and can be manually operated above the ditch

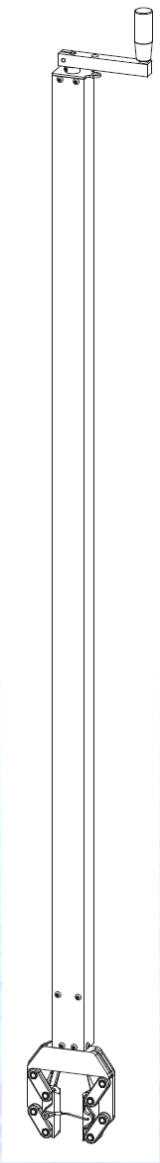
Timberline Tool

6-inch down to ½-inch CTS

Squeeze-off tools require minimum torque

Light weight - High Strength Aluminum
Easy to turn - Screw Drive
Fool proof - Replaceable Jaws, Hard Positive Stop

Three sizes:
6” to 3” Model #650
2” to ½” CTS Model #270
1” IPS to ½” CTS Model #170



Lifting and Loading
Slips Trips & Falls

- Lift Gate easily loads and unloads heavy equipment off vehicles
- Powered Hand Truck moves heavy loads up stairs, off truck
- “Big Red” mechanical lifting hand truck for 1000 meters
- Gas Meter Carriers
- Anti-Static Spray – don’t have to get in ditch

Lifting and Loading

Lift Gate easily loads and unloads heavy equipment off vehicles

Crew Truck
- drills,
- hot tap equipment,
-Jackhammers
-Gas cylinders
-Water pumps

Service Vans

Truck or Van Mounted – consider retrofit or new Ergo vehicle design

Power Mate

Lifting and Loading

POWERED HAND TRUCK moves heavy loads up stairs, off truck

Stairs
- Appliances,
- Large Meters
- Regulators

"We recently purchased a Powermate hand truck… What an incredible purchase! Our mechanics love the Powermate, and these material moves are much safer, faster, and easier than before. A senior mechanic even wanted to kiss me after he used our Powermate for the first time… And here's a bonus, it's so easy to work that even a supervisor can use it!"

M.J. Smith, Maintenance Supervisor

Pick up truck
- Cold Patch,
- Cement

Power Mate

Lifting and Loading

Large diaphragm meters are awkward to connect and hang on to at the same time.

“Big Red” lifting hand truck has a platform that cranks to the right height to position the larger 1000 CFH meters as you change them.

The cart weights 75 lbs.
Height 51”, Width 23”, Depth 30”
Lifting toe plate comes up 18”

#375

Designed for and field approved by a utility. Multi-utility evaluations have mixed results with some saying it’s too big and heavy and other users happy with it. Help me make a lighter version!

Slips Trips and Falls: Gas Meter Carrier

- No threading onto the spuds
- Cap stays on during transport
- Easy to use - good acceptance in the field
- One tools fits most meters
- Balances the load, no awkward carry

#301

Slips Trips and Falls: Gas Meter Carrier

Features:

- **Carry Meters Easily**
- **Comfortable Hand Grip**
- **Pads won't Scratch the Paint**
- **8" Slot for (175, 225, & 250) &**
- **10½" Slot for (425 & 630) Meters**
- **Holds the Meter in Place During Changes so You don't have to Kneel or Bend**

Slips Trips and Falls
Anti Static Spray Improves Productivity Over Soapy Burlap, Plastic Tape

- Wrapping soapy burlap or conductive tape takes longer – awkward body position
- Spray applied to plastic pipe in less than a minute vs. ten or fifteen to wrap burlap or plastic tape
- Third party testing report shows no PE degradation or problem with fusion
- Long handled applicator, don't need to get in the ditch to spray

So there are lots of tools, but……..

How do you know what you need?

How do you find out what tools/training are out there?

How do you test and evaluate the tools?

How do you get your field crews to use the tools?

How do you ensure the tools and training are giving you the results you want?

New Practices and Tools Need to be Identified, Evaluated and Implemented in a Three Step Process

- **First, find out what activities are causing injuries**
- **Second, set up a tracking and evaluation process**
- **Third, deploy new tool/procedure**

First, find out what activities are causing injuries

- **Top-down analysis from workmen's comp. injury reports, AGA statistics, other utilities**

Program with 11 utilities identified top six causes:

1) & 2) **Wrenching, Barholing**

3) & 4) **Lifting & Loading, Digging in Trench**

5) & 6) **Slips Trips and Falls, Vehicle Design**

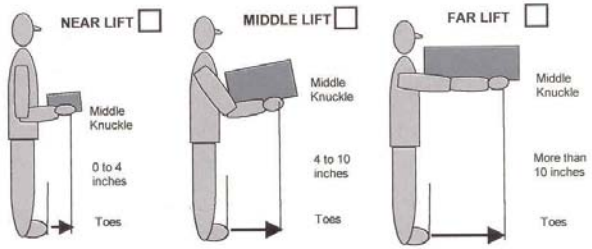
- **Bottom-up analysis. Ask the field people who are doing the job.**

- **In-the-middle analysis – formal Ergo task risk analysis**

PG&E Ergonomic Risk Factor Based Assessment Tool – gives you a number

MANUAL MATERIAL HANDLING

NEAR LIFT ☐ MIDDLE LIFT ☐ FAR LIFT ☐



STEP 1:

Determine if the Lift is Near, Middle, or Far (Body to Hands)

- Use an average horizontal distance if a lift is made every 10 minutes or less.
- Use the largest horizontal distance is more than 10 minutes pass between lifts

STEP 2:

Estimate the Weight Lifted

- Use an average weight if a lift is made every 10 minutes or less
- Use the heaviest weight if more than 10 min. pass between lifts
- Enter 0 in the total score if the weight is 10lb or less

NEAR LIFT	
Danger Zone	More Than 51 lbs **5 Points**
Caution Zone	17 to 51 lbs **3 Points**
Safe Zone	Less Than 17 lbs **0 Points**

MIDDLE LIFT	
Danger Zone	More Than 35 lbs **6 Points**
Caution Zone	12 to 35 lbs **3 Points**
Safe Zone	Less Than 12 lbs **0 Points**

FAR LIFT	
Danger Zone	More Than 28 lbs **6 Points**
Caution Zone	10 to 28 lbs **3 Points**
Safe Zone	Less Than 10 lbs **0 Points**

STEP 2 SCORE

STEP 3:

Determine the Points for Other Risk Factors

- Use occasional lifts if more than 10 minutes pass between lifts
- Use the more than 1 hour column if the risk factor occurs with most lifts and lifting is performed for more than 1 hour

FACTORS	Occasional lifts (performed for 1 hour or less in total per shift)	Lifts performed for more than 1 hour in total per shift	SCORE*
Twist torso during lift	1	1	
Lift one handed	1	2	
Lift unstable loads (i.e. People, liquids)	1	2	
Lift between 1-5 times per minute	1	1	
Lift 5 or more times per minute	2	3	
Lift above shoulder	1	2	
Lift below knuckle	1	2	
Carry object 10 to 30 feet	1	2	
Carry object farther than 30 feet	2	3	
Lift while seated or kneeling	1	2	

STEP 3 SCORE

* ACTION PRIORITY on values of 2 or 3

TOTAL SCORE: Manual Materials Handling (STEP 2 + STEP 3)	

TASK Date: _____ Task evaluated: _____ TOTAL SCORE: _____

EVALUATOR Employee name/Job title: _____ Prepared by: _____

Back	Bending Forward/Sideways	Bending Forward/Sideways	Twisting	Sitting Unsupported	Static Posture	Repetition	Force	Total Back Score
	> 20° but < 45°	> 45°			Holding Posture 5-20 sec ☐ 1 > 20 sec ☐ 3	>25/day ☐ 1 >20/hr ☐ 3	> 25 lbs ☐1 > 50 lbs ☐3 > 75 lbs ☐10 (Weight Lifted) >20 lbs ☐3 Push/pull force	Action Priority if value 3 or 10
score	☐ 1	☐ 3	☐ 3	☐ 1	☐ 1 ☐3	☐ 1 ☐3	☐1 ☐3 ☐10	

Neck	Bending Forward	Bending Backward	Bending Sideways	Twisting	Static Posture	Repetition	Force	Neck Score
	> 30°	> 10°	> 20°	> 20°	Holding Posture 5-20 sec ☐ 1 > 20 sec ☐3	1-5/min ☐1 5-15/min ☐3	Supporting weight or Head Gear	Action Priority on value of 3
score	☐ 3	☐ 3	☐ 1	☐ 1	☐ 1 ☐3	☐ 1 ☐3	☐ 1	

Shoulder	Flexion Upper Arms	Overhead Work	Arm behind body	Shoulders Shrugged	Abducted Shoulder	Static Posture	Repetition	Force	Shoulder Score
	(> 15° but < 45°) > 45°	> 90°	>- 5°			Holding Posture 5-20 sec ☐ 1 > 20 sec ☐3	1-5/min ☐1 5-15/min ☐3	> 10 lbs (Lifted or Force applied)	Action Priority if value 3 or 10
Right	☐ 1	☐ 3	☐10	☐ 3	☐ 3	☐ 1	☐ 1 ☐3	☐ 1 ☐ 3	☐ 1	Right
Left	☐ 1	☐3	☐10	☐ 3	☐ 3	☐ 1	☐ 1 ☐3	☐ 1 ☐ 3	☐ 1	Left

Elbow	Flexion Elbow	Fully Extended	Forearm Rotation	Static Posture	Repetition	Force	Elbow Score
	> 90°	<0°		Holding Posture 5-20 sec ☐ 1 > 20 sec ☐3	1-5/min ☐1 5-15/min ☐3	> 10 lb (Lifted or Force applied)	Action Priority on values of 3
Right	☐ 1	☐ 3	☐ 1	☐ 1 ☐3	☐ 1 ☐3	☐ 1	Right
Left	☐ 1	☐ 3	☐ 1	☐ 1 ☐3	☐ 1 ☐3	☐ 1	Left

Wrist	Flexion Wrist	Extension Wrist	Radial Deviation	Ulnar Deviation	Static Posture	Repetition	Force	Wrist Score
	>30°	>30°	Thumb	Thumb	Holding Posture 5-20 sec ☐ 1 > 20 sec ☐3	1-5/min ☐1 5-15/min ☐3	>10 lbs (power grip) > 5 lbs (tool)	Action Priority if value 3 or 10
Right	☐ 3	☐ 3	☐ 1	☐ 1	☐ 1 ☐3	☐1 ☐3	☐ 3	Right
Left	☐ 3	☐ 3	☐ 1	☐ 1	☐ 1 ☐3	☐ 1 ☐3	☐ 3	Left

Hand	Gloves Worn	Awkward Grip	Finger Extended	Hand as Hammer	Pinch Grip>2 lbs	Finger Press	Hand score
	☐1	☐ 3	☐ 1	☐ 3	☐ 3	☐ 1	

Legs	Kneeling	Kneeling	Squatting	Static Posture	Repetition	Standing (hard floors)	Floor Traction	Leg Score
	1-Knee ☐ 1	2-Knees ☐ 3	☐ 3	☐ 3	☐ 3	☐ 1	☐ 1	

Additional Factors	Whole Body Vibration	Hand/Arm Vibration	Hard/Sharp Objects Press into skin	Hot/Cold Temperatures	No Worker Control	> 4 hour Duration	> 8 hour Duration	Additional factor score
	☐ 1	☐ 3	☐ 1	☐ 1	☐ 1	☐ 3	☐ 10	

Complete Material Handling Assessment if manual lifting is a major component of the Task evaluated

Posture, awkward position, force, repetition, vibration, exposure duration, overtime, temperature, etc.

Second, set up a tracking and evaluation process

- Assign responsibility: who is in charge of the tool evaluation, who are the field people testing the tool?
- Why are you testing the tool? What benefit are you expecting?
- Develop easy to use field evaluation forms
- Give the tool enough time, but not too much
- Keep on top of it
- Write up the results of the field trial

Tracking and Evaluation requires management support, and feedback from the field

Need internal technical and management support
"Why are we looking at this tool?"

- Description of problem
- Scope of testing requested
- What departments are impacted
- Business Purpose / Value
- Estimated annual usage and savings

Field evaluation information is critical

“Field Evaluation Form for new tools”

- Who evaluated it and for how long
- Ease of use, frequency of use
- Specifics (vibration, handle position, body position, etc.)
- Suggested improvements
- Other tools that could do the job better
- Would you recommend this tool to a friend

Example of Tool Field Evaluation Form

CONSUMERS ENERGY
TOOL EVALUATION FORM

TOOL CONSULTANT: _____

DELIVERED TO: _____

HEADQUARTERS: _____

DATE DELIVERED: _____

EVALUATION DUE: _____

Please take the time to complete this tool/product analysis and help us evaluate the tools/products that will make your job safer.

I. Tool Information

Type of Tool/Product: _____

Manufacturer: _____

Model Number: _____

Evaluated by: _____

II. Background Information (Please circle the appropriate response)

How long have you been in your occupational group?

0 – 2 years 2 – 5 years 5 – 10 years 10 years or more

How often do you use this type of tool/product?

Rarely Seldom Occasionally Often

How much time did you spend using this tool/product?

Less than 1 hour 1 – 2 hours 2 – 5 hours 5 hours or more

Example of Tool Field Evaluation Form

III. Tool Evaluation (Please circle the appropriate response)

Please rate this tool based on your experience and against current tools/products in use with the following scale:

1 = Poor 2 = Below Average 3 = Average 4 = Above Average 5 = Superior

Weight 1 2 3 4 5	Trigger Design 1 2 3 4 5	Position of Your Back 1 2 3 4 5
Balance 1 2 3 4 5	Handle Design 1 2 3 4 5	Ease of Use 1 2 3 4 5
Vibration 1 2 3 4 5	Natural Wrist Angle 1 2 3 4 5	Performance 1 2 3 4 5
Noise 1 2 3 4 5	Natural Shoulder Angle 1 2 3 4 5	Overall Opinion 1 2 3 4 5

IV. Additional Comments:

Are there any changes that you would make to improve this tool/product?

Are there any tools/products that you are aware of that are similar and perhaps better?

Are there any other comments or safety concerns you would like to make about this tool/product?

Thank You!

We would like to thank you for taking the time to evaluate this tool/product. Your input was vital in effectively evaluating this tool/product.

RETURN COMPLETED FORM TO YOUR TOOL CONSULTANT

Third, deploy new tool

- Work with manufacturer for any final modifications
- Set up in Purchasing – watch the specifications!
- Support purchases by co-funding – not too much or too little
- Spread the word – use internal communication that already works
- Involve Training, Supervisors, Safety & Health
- Phased deployment reduces risk and helps gain acceptance

Conclusions

- As medical costs rise and the workforce ages, new tools and practices can help improve safety.
- Wide variety of tools and training available.
- It helps to have a formal procedure for identification, evaluation and implementation.

For latest product information visit my website:

www.ErgonomicToolDevelopment.com

For more information, a catalog, or tool demonstrations contact me:

BruceKCampbell@comcast.net or

Bruce@Ergonomictooldevelopment.com

Bruce K. Campbell
Consulting & Sales
224 - 715 - 3699

Lowering costs and improving safety through technology deployment