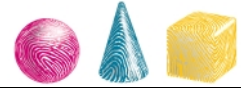


# Ergonomics for Public Utilities



Ergonomic Technologies Corporation

## Using Ergonomics to Improve Safety and Productivity

Ergonomics (the Laws of Work) is the study and design of the work environment to be consistent with the capabilities & limitations of the working population.

Ergonomics is a Kaizen process, a continuous improvement approach to the workplace which when effectively implemented can result in increased productivity, improved quality, reduced injuries, increased job satisfaction and worker morale.

Employees in the Public Utility industry are exposed to many job factors that may contribute to the development of ergonomic injuries and reduce productivity. Some of these job requirements include:

- Heavy lifting & bending
- Awkward upper extremity postures
- Contact stress: knees, hands



- Hand/arm & whole body vibration
- Cold temperatures
- Kneeling
- Shoveling
- Hand tool use: Shovels, tampers, digging bars, plunger bar (slide hammer), hammers, wrenches
- Heat stress
- Air tools use: Breakers, rock drills, impact guns
- Excavating equipment: vibration & seating
- Climbing in/out of trenches
- Prolonged standing
- Inadequate lighting

The effective management and implementation of an ergonomics program is crucial in the prevention and control of ergonomic hazards in the workplace, leading to a safe and healthful work environment.



## Services Offered for Public Utilities

The following services are offered by ETC to the Public Utilities industry.

- Ergonomic Audits
- Corporate Ergonomic Guidelines including Tooling and Equipment Specifications
- Ergonomic Risk Assessment including Recommendation and Solution Development
- Training & Education
- Evaluation of Tool, Product, and Equipment Characteristics
- Development, Testing, and Refinement of Product Concepts

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### ETC Public Utility Experience

- Keyspan Energy
- Brooklyn Union Gas
- Lilco
- ConEd
- Louisville Gas and Electric
- Rochester Gas and Electric
- Salt River Project
- Baltimore Gas and Electric



## Keyspan Ergonomics Initiative for the Maintenance Service Department (MSD)



In 1997, concerns for workers health and safety sparked an ergonomics initiative at Keyspan Energy. Some of the issues were demanding physical work, difficult work environments and a high number of injuries.



Using a team approach, the R&D Department worked closely with the Maintenance Service Department and ETC, an ergonomics expert to identify and solve some of the major ergonomics problems.



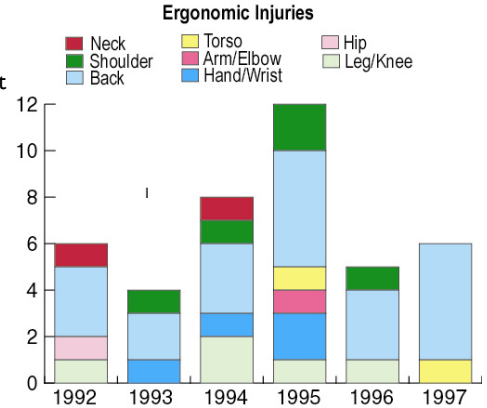
An interactive relationship with the MSD workers was developed to insure that solutions would be readily adopted.



An evaluation of ergonomic injuries revealed that the problems areas included back, shoulders, hands/wrists.

Over 65 tasks were evaluated during turbine assembly and disassembly, ductwork, pipe installation, burner corner assembly and insulator replacement.

The on-site data collection consisted of observation and videotape of work, talking with



workers and documentation of dimensions and weights. Several job requirements were identified as potential contributors to musculoskeletal stress and injury.

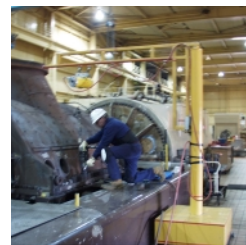
### Back Bending & Lifting

Employees were taught to avoid lifting and twisting, avoid heavy lifting and sitting and avoid static bending. Lift tables reduced bending by 81%.



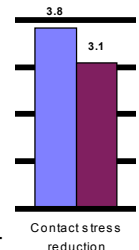
### Arm Postures & Force

Employees were taught to avoid raised (overhead) or extended arm postures. They were also given a portable jib crane to limit the load.



### Mechanical Contact Stress

To reduce the risks associated with mechanical contact stress employees were taught to reduce or avoid kneeling, and reduce impact loading during heavy physical work.



An analysis of knee pads and mats revealed subjective differences.

### Hand-Arm Vibration

To reduce the risks associated with vibrating tool use, employees were taught to reduce exposure time, maintain tools, reduce tool weight through a balancer and to grip tool as necessary.

An objective assessment was conducted to identify the most effective anti-vibration glove.



### Impact: Hand & Elbow

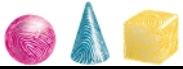
To reduce the risks associated with impact/shock to the hand and elbow, employees were provided with fiberglass handled hammers.

Objective testing revealed lower impact handle response and 55-60% lower transmission from head to handle.



### Cost/Benefit of Program

- \$162,000 annual cost reduction
- 9:1 Dollar benefit to cost ratio for ergonomics program
- Noticeable improvement in worker productivity and morale
- Regulatory compliance
- Marketable new tools and equipment



## Keyspan N2 Bottle Project

*Giving Heavy Bottles and and Electric System Operations Employees a Lift* By Ellen Cooke

"We really went the extra mile," claims Hal Truhn, General Shops, Brentwood. Truhn is referring to a recent project that pooled the talents of General Shops (a maintenance services organization), Electric System Operations (ESO) and Research & Development (R&D) to develop a safe, easy alternative to heavy lifting that could cut down on work-related injuries even as it saves the Company money. ESO multi-station operators (MSOs) are responsible for sub-station maintenance, which includes lifting, transporting, unloading and refilling heavy nitrogen bottles used for insulating transformers and cables.

"The bottles are four-feet-high, weigh up to 130 pounds and have to be maneuvered in and out of the back of a mini-van, which is physically challenging,"

says Tom Barracca, KeySpan's Electric R&D manager. The 35 employees who do this work unload these bottles up to four times a day. The Solution ESO came to R&D looking for a solution that would minimize the risks of back and other bodily injury - risks that hurt the Company financially as much as they hurt workers physically. They found it through an R&D Initiative project. Now, a pneumatic system comprised of a five-gallon air tank, wiring and control valves, and a compressor uses compressed air to lift, position and load and unload bottles from the mini-van.

**"We've received enthusiastic feedback from the workers because they had a great deal of input into the design,"** says Bob Opitz, ESO sub-station operations engineer. "While an outside firm designed the original prototype, KeySpan employees modified and enhanced it to meet their own

needs. And they did it quickly and more cost-effectively than if we went outside." "We designed a large, metal cab- to house the bottle; a fully adjustable clamp to fit different-sized bottles; more durable air lines and much more. It's all designed to be very simple - not too 'gadgety,' but strong and capable of lasting," says Truhn, who headed up General Shops' redesign of the system based on input from the end-users, ESO workers. **"The bottom line is it's much easier to load, unload and maneuver the bottles,"** says Tom Costa, MSO, Holtsville.

**"All of the stress on your back, shoulders and legs is gone, which makes a lot of us very happy."** Barracca calls the final, patent-pending product "field-rugged" and "user friendly," and says it could soon be marketed to other utilities, and other industries such as hospitals and fire departments.



*Redesign of N2 bottles through Keyspan's R&D Initiative Project*

## Anti-Vibration Glove Assessment when operating the Pavement Breaker, Rotary Drill, & Spader

### Objective

The objective of this assessment was to quantify the vibration damping characteristics of alternative gloves when operating a pavement breaker, rotary drill, and spader to assist and validate the future implementation.

### Methods

The damping characteristics of the current work glove and three anti-vibration gloves were assessed during the operation of three commonly used Gas Construction & Maintenance (GC&M) tools. These included the current work glove and three anti-vibration gloves.

### Test Procedures

Test trials took place in a Brooklyn Union Gas Service Center. A GC&M worker with 25 years of experience operated each tool while wearing each type of glove. Four, 25-second test trials per glove per tool were conducted. All the gloves were tested using one tool before changing tools. The tools were used on approximately six-inches of asphalt (e.g., asphalt blade used with pavement breaker).

### Vibration Assessment

Vibration was measured using a tri-axial accelerometer configuration between the padding of the gloves and the palm of the

hand, per the American National Standard ANSI S3.34-1986. This standard states, measurements shall be taken where the energy enters the surface of the hand and that a thin metal mount shall be used between the hand and the padding of a glove.

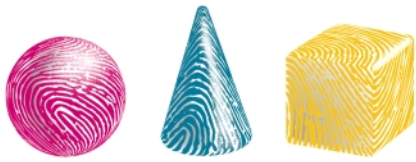
### Results

Best vibration damping characteristics were identified for each tool.





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### About ETC

Ergonomic Technologies Corporation (ETC) was formed by advanced degreed engineers and a registered professional nurse with over 50 years combined experience in the application of ergonomics in industry. ETC's intention is to assist our clients in the design work tasks, products and tools that meet the needs of their employees and customers. To meet the challenge of competitive markets for the 21st century, ETC has the technology and capability to provide our clients with the competitive advantage for the future.

ETC specializes in the use of objective measurement systems to analyze human interactive systems. The use of quantitative methods allows ETC to be confident in the validity and appropriateness of our recommendations and solutions.

ETC believes that it is essential to continually improve the methods available for workplace and product assessment that result in a reduction in injuries and operating costs with an increase in productivity. To this end, ETC maintains an active Research and Development effort dedicated to the development and advancement of ergonomic tools and techniques.

This effort has resulted in the conceptualization of several unique measurement devices and software for managing the workplace ergonomics process.

### Public Utilities Expert

ETC maintains a multi-disciplinary team of Certified Professional Ergonomists, Industrial and Mechanical Engineers, Industrial Designers, Computer Programmers and Medical Personnel.

The expertise of the group includes hands-on experience at almost every type of industrial, service and office work environment. This collective knowledge is extremely important in reducing the time necessary to identify and implement feasible and cost-effective solutions for workplace and product improvement.

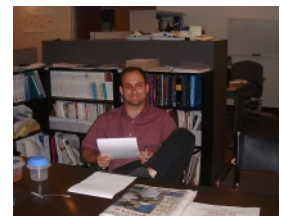
In addition, we encourage our ergonomists to become ex-

perts in one or more industries. This enables them to develop an in-depth understanding of the workplaces and environments associated with the jobs they will be evaluating. This saves time and financial savings for the client based on prior experience and an understanding of industry specific issues.

ETC's Public Utilities expert is Scott Valorose. Mr. Valorose has performed workplace design and training for Keyspan, Brooklyn Union Gas, Lilco, ConEd, Louisville Gas and Electric, Rochester Gas and Electric, Salt River Project and Baltimore Gas and Electric.

Mr. Valorose has had experience with the following Public utilities areas:

- Gas construction
- Gas maintenance & service
- Electric power operation
- Electric transmission and distribution



Scott A. Valorose  
ETC Public Utilities Expert