Curriculum Vitae of Richard W. Marklin, Jr., Ph.D., CPE
(2005 to present)

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RESEARCH INTERESTS

Physical ergonomics (human factors engineering), work-related musculoskeletal disorders (MSDs), hand tool and product design, engineering & industrial design collaboration, STEAM (Science, Technology, Engineering, Art, and Math)

EDUCATION

Ph.D. August, 1991, The Ohio State University
Department of Industrial and Systems Engineering (Specialty: Physical Ergonomics)
Dissertation: Quantification of the association between wrist motion and incidence of cumulative trauma disorders (CTDs) in industry

M.S. March, 1988, The Ohio State University
Department of Industrial and Systems Engineering (Specialty: Physical Ergonomics)
Thesis: The effects of hammer handle angle on wrist motion, hammering performance, and subjective ratings.

B.F.A. With distinction, 1981, The University of Kansas, Industrial Design

WORK EXPERIENCE

2005 to present **Professor of Mechanical and Biomedical Engineering**
Marquette University, Milwaukee, WI
Department of Mechanical Engineering
(Joint appointment with the Dept. of Biomedical Engineering)
Responsibilities: teaching undergraduate and graduate courses in the Mechanical Engineering curriculum, physical ergonomics and STEAM design research, advising students, directing the Ergonomics Laboratory, community service.

1997 to 2005 **Associate Professor of Mechanical, Industrial and Biomedical Engineering**
Marquette University, Milwaukee, WI

1991 to 1997 **Assistant Professor of Mechanical and Industrial Engineering**
Marquette University, Milwaukee, WI

1981 to 1985 **Senior Associate Industrial Designer**
IBM, Rochester, MN
Responsibilities: new product development of IBM System/36 processors (5362 and 5364) and several conceptual processors and systems

PROFESSIONAL REGISTRATION

CPE, Certified Professional Ergonomist, #405, August 5, 1994

MEMBERSHIPS

1987 to present Human Factors and Ergonomics Society (HFES)
1987 to present International Ergonomics Association (IEA)

PATENTS AND TECHNICAL DISCLOSURES

- September 8, 2017. U.S. and international utility patent application for "Electrical Power Assisted Device for Controlling an Aerial Bucket with a Hydraulic Movement System". Inventors: Jonathon E. Slightam, Mark L. Nagurka and Richard W. Marklin, Jr. PCT application No. PCT/US2017/050715. Andrus Ref # 5528 00140.

- April 15, 2016. U.S. and international utility patent application for "Smart Trigger System". Inventors: Mark L. Nagurka and Richard W. Marklin, Jr. Andrus Ref # 5528 00098.

- September, 2016. "Nail Remover Tool with Sliding Fulcrum and Dimple". Patent application #14/798,003. U.S. utility patent will be issued to Marquette U. in Sept. 2016. Inventors: Richard W. Marklin, Jr., and six undergraduate engineering students. Invention was the culmination of a senior design project.

- 2001. U.S. Patent on Ergonomic Dental Stool US D439,066 S (Kevin Cherney) (Note: The stool was designed to a large extent by Kevin Cherney, a former graduate student of R.W. Marklin and a co-holder of this patent, while he was supported by a grant from The Brewer Co. and performing graduate work at Marquette University. Although R.W. Marklin is not a holder of this patent, he was the P.I. of the grant from The Brewer Co.)

- 1985, 1987. U.S. Patents on the IBM 5362 and 5364 systems.

- 1984, 1986. Technical disclosures in IBM Technical Disclosure Bulletin.

AWARDS AND HONORS TO R.W. MARKLIN AND STUDENTS (since 2005)

2012-2013 – *Outstanding Teacher Award in Mechanical Engineering*. *Presented by Dept. of Mechanical Engineering Industrial Advisory Board, April 2014.*

2010 – *Best Presentation* *at the Ergonomics Committee sessions during the American Industrial Hygiene Conference & Exhibition (AIHCE), Denver, CO, May 24, 2010.*

2009 - *1st Place in* ***Department of Mechanical and Industrial Engineering Graduate Poster Competition****: Stephen Freier (R. Marklin and P. Papanek, Advisors).* "Office Chair Reduces Heart Rate"

2008-2009 – *Outstanding Teacher Award in Mechanical Engineering*. *Presented by Dept. of Mechanical Engineering Industrial Advisory Board, April 2010.*

2007 – *2nd Place in* ***Department of Mechanical Engineering Graduate Poster Competition****: Hector Sánchez (R. Marklin Advisor).* "Biomechanical Analysis of Screwdriver Handle Designs"

2006 – *Robert and Mary Gettel Faculty Award for Teaching Excellence* *(one of 3 awarded annually from Marquette University). Cash award of $5000.*

2006 – ***Outstanding Researcher Award in the College of Engineering*** *(one awarded annually from the College). Cash award of $1000.*

JOURNAL ARTICLES IN PRINT (since 2005)

Marklin, R.W., Toll, A.M., Bauman, E.H., Simmins, J.J., LaDisa, J.F., and Cooper, R. (August 24, 2020). Do head-mounted augmented reality devices affect muscle activity and eye strain of utility workers? Studies of plant operators and manhole workers. *Human Factors,* DOI: 10. 1177/ 0018 7208 20943710, pp. 1-18.

EPRI (2019). (Marklin, R.W., PI). *Safety Aspects of Using Augmented Reality Technologies: Field Tests with Electric Utility Power Plant Operators and Manhole Workers*. EPRI Report, 10008884.

EPRI (2018) (Marklin, R.W., PI). *Program on Technology Innovation: Augmented Reality—Literature Review of Human Factors Issues in the Electric Power Industry*. EPRI Report, 3002012532.

EPRI (2017) (Marklin, R.W., PI). *Decision Tool for Implementation of Recommended Overhead and Underground Distribution Ergonomic Interventions*. EPRI Report, 3002011194.

EPRI (2017) (Marklin, R.W., PI). *Aerial Bucket Pistol Grip Control to Reduce Muscle Fatigue of Electric Utility Line Workers*. EPRI Report, 3002012047.

Nagurka, M.L. and Marklin, R.W. (2017). Smart trigger: Development of a system to improve nail gun safety. *Professional Safety,* pp. 31-38.

Marklin, R.W. and Bain, B. (2016). Electric line workers' ingress and egress to aerial buckets: Design features to reduce risk of a slip or fall. *Theoretical Issues of Ergonomics Science*, Vol. 18, Issue 5 (DOI:10.1080/1463922X.2016.1226446, pp 1-18.)

Conrad MO, Marklin RW (2014) Evaluation of Forearm Muscle Fatigue from Operating a Motorcycle Clutch. *J Ergonomics* S4: 006. DOI:10.4172/2165-7556.S4-006

Marklin, R., Goldberg, J., and Nagurka, M. (2013). Freehand sketching for engineers: A pilot study. *120th American Society of Engineering Educators (ASEE) Annual Conference and Exposition*. June 23-26, Atlanta, GA. (This was a full-length article that was peer-reviewed twice.)

Moriguchi, C., Carnaz, L., Miranda Jr., L.C., Marklin, R.W., Gil Coury, H. (2012). Are posture data from simulated tasks representative of field conditions? Case study for electric utility overhead workers. *Ergonomics*, August, 1-13, Ifirst article. (DOI:10.1080/00140139,2012,708439).

Moriguchi, C.S., Carnaz, L., Carlos de Miranda Jr., C., Marklin, R.W., Gil Coury, H.J.C. (2012). Biomechanical analysis of loading/unloading a ladder on a truck. *WORK: A Journal of Prevention, Assessment & Rehabilitation*, Vol. 41, pp. 2492-2495.

Stone, R. Marklin, P. Seeley, and G. Mezei, A collaborative effort to apply ergonomics to electric utility workers at generating stations (2011). *WORK: A Journal of Prevention, Assessment & Rehabilitation*. Volume 39, No. 2, Nov. 2011. pp. 103 – 111.

Saginus, K., Marklin, R., Seeley, P., and Freier, S. (2011). Optimal location of mobile computer in a vehicle cab based on physical ergonomics. *Human Factors,* Vol. 53, No. 5, 474-488.

Marklin, R.W., Saginus, K., Seeley, P., and Freier, S. (2010). Comparison of anthropometry of US electric field workers with North American databases. *Human Factor*s, Volume 52, No. 6, Dec. 2010, 643-662.

Harivanam, S., Marklin, R.W., Papanek, P.E., and Cariapa, V. (2010). A Shovel with a perforated blade reduces

normalized energy expenditure required for digging and shoveling wet clay. *Human Factors*, Vol. 52, No. 4, pp. 492–502

Weiszczyk, S., Marklin, R.W., Sanchez, H.J. (2009). Height of industrial hand wheel valves affect torque exertion. *Human Factors*, 51(4), 487-496.

Seeley, P., Marklin, R., Usher, D. and Yager, J. (2008). Case Study Report: Business Case for implementing battery-powered tools for direct-bury line workers at an electric power utility. *Journal of Occupational and Environmental Hygiene*, 5:D86-D91.

Bufton, M., Marklin, R.W., Nagurka, M.L., and Simoneau, G.G. (2006). Finger typing forces applied to conventional and notebook computer keyboards. *Ergonomics*, Vol. 49, No. 10, 996-1012.

Stone, A., Usher, D., Marklin, R., Seeley, T. and Yager, J. (2006). Case study for underground workers at an electric utility: How a research institution, university and industry collaboration improved occupational health through ergonomics. *Journal of Occupational & Environmental Hygiene*, 3: 397-407.

Nagurka, M.L. and Marklin, R.W. (2005). Measurement of impedance characteristics of computer keyboard keys. *J. of Dynamic, Systems, and Motion Controls*, Vol. 127, 283-288. .

Marklin, R.W. and Cherney, K. (2005). Working postures of dentists and dental hygienists. *Journal of the California Dental Association*, 33(2), 133-136.

YOUTUBE CHANNEL

Marklin Freehand Sketcher YouTube channel created Fall, 2019, at Technical University, Delft, Netherlands. A set of 10 videos that show how any person can learn how to sketch freehand manufactured objects with parallel drawing systems (orthographic, isometric, and oblique).

HANDBOOKS IN PRINT

Marklin, R.W. and Stone, A. (2018). *EPRI Ergonomics Handbook for the Electric Power Industry: Tasks with Awkward Postures by Body Part and Future Research Opportunities*. EPRI, Palo Alto CA, 3002013828, 700 pages.

Seeley, P. and Marklin, R.W. (2012). *EPRI Ergonomics Handbook for the Electric Power Industry: Ergonomic Design and Specifications of Turnkey and Upfitted Fleet Vehicles.* EPRI, Palo Alto CA, 1021835, 664 pages.

Seeley, P. and Marklin, R.W. (2011). *EPRI Ergonomics Handbook for the Electric Power Industry: Process and Maintenance of Fleet Utility Vehicles.* EPRI, Palo Alto CA, 1021836, 232 pages.

Marklin, R.W., Seeley, P., and Mezei, G. (2010). *EPRI Ergonomics Handbook for the Electric Power Industry: Ergonomic Design of Substations and Ergonomic Interventions for Overhead, Underground, and Substations Tasks.* EPRI, Palo Alto CA, 1021128, 490 pages.

Marklin, R.W., Yager, J. and Mezei, G. (2009). *EPRI Ergonomics Handbook for the Electric Power Industry: Ergonomic Interventions for Plant Operators and Mechanics in Fossil-Fueled Power Plants*, EPRI, Palo Alto CA, 1014042.

Marklin, R.W., Yager, J. and Mezei, G. (2008). *EPRI Ergonomics Handbook for the Electric Power Industry: Ergonomic Interventions for Electrical Workers in Fossil-Fueled Power Plants*, EPRI, Palo Alto CA, 1014042.

Marklin, R.W. and Yager, J. (2005). *EPRI Ergonomics Handbook for the Electric Power Industry: Ergonomic Interventions for Direct-Buried Cable Applications*, EPRI, Palo Alto CA, 1005574.

Marklin, R.W. and Yager, J. (2004). *EPRI Ergonomics Handbook for the Electric Power Industry: Ergonomic Interventions for Manhole, Vault and Conduit Applications*, EPRI, Palo Alto CA, 1005430.

Marklin, R.W. and Yager, J. (2001). *EPRI Ergonomics Handbook for the Electric Power Industry: Overhead Distribution Line Workers Interventions*, EPRI, Palo Alto CA, 1005199.

REFEREED CONFERENCE PROCEEDINGS IN PRINT (since 2005)

Toll, A.M., Marklin, R.W., Bauman, E.H., and Simmins, J.J. (2020). Effect of head-mounted augmented reality systems on electric utility manhole workers: neck muscle activity and eye strain. *Proceedings of the Human Factors and Ergonomics Society 64rd Annual Meeting*, Oct. 5 to 9, Chicago, IL.

Marklin, R.W., Toll, A.M., Bauman, E.H., and Simmins, J.J. (2019). Effect of two common head-mounted augmented reality systems on muscle force and blink rate of electric utility power plant workers. *Proceedings of the Human Factors and Ergonomics Society 63rd Annual Meeting,* Oct. 29 to Nov. 1, 2019, Seattle, WA, pp. 1132-136.

Marklin, R.W., Slightam, J.E., Nagurka, M.L., Garces, C.D., Krishen, L., Bauman, E.H. (2018). New pistol grip control for an electric utility aerial bucket reduces risk of forearm muscle fatigue. *Proceedings of the Human Factors and Ergonomics Society 62st Annual Meeting,* Oct. 2-5, 2018, Philadelphia, PA.

Marklin, R.W. and Seeley, P. (2017). Communicating ergonomics with management on ROI and Acceptability – Part 2: Ergonomics ROI for electric utility battery-powered cutting and crimping tools. *Proceedings of the Human Factors and Ergonomics Society 61st Annual Meeting,* Oct. 10-13, 2017, Austin, TX, pp. 963-967.

Marklin, R.W., Slightam, J.E., Nagurka, M.L., Wolff, T.M., Garces, C.D., and Krishen, L. (2017). Applied force and sEMG muscle activity required to operate pistol grip control in electric utility aerial bucket. *Proceedings of the Human Factors and Ergonomics Society 61st Annual Meeting,* Oct. 10-13, 2017, Austin, TX, pp. 973-975.

Hickok, M., Marklin, R.W., Nagurka, M. and Simoneau, G. (2014). Screwdriver bit design - Effect of Phillips, straight, and hybrid design on torque, axial force, and effort ratio. *Proceedings of the Human Factors and Ergonomics Society 58th Annual Meeting,* Oct. 27-31, 2014, Chicago, IL.

Saginus, K. and Marklin, R.W. (2014). Ingress and egress to utility trucks – Design of steps and stairs. *Proceedings of the Human Factors and Ergonomics Society 58th Annual Meeting*, Oct. 27-31, 2014, Chicago, IL.

Conrad, M. and Marklin, R.W. (2014). Motorcycle clutch grip strength. *Proceedings of the Human Factors and Ergonomics Society 58th Annual Meeting,* Oct. 27-31, 2014, Chicago, IL

Marklin, R.W., Matthison, M., Mayer, B., Nagurka, M., Cariapa, V. and Schabelski, J.(2013). Aquaponics: A sustainable food production system that provides research projects for undergraduate engineering students. *World Engineering Education Forum (WEEF)*, Sept 24-27, Cartagena, Colombia.

Nagurka, M., Antón Rodriguez, F. and Marklin, R.W. (2013). Using remote access for sharing experiences in a machine design laboratory. *World Engineering Education Forum (WEEF)*, Sept 24-27, Cartagena, Colombia.

Saginus, K., and Marklin, R.W. (2013). The effects of mobile computer location in a vehicle cab on muscle activity and body posture of large and small drivers. *Proceedings of the Human Factors and Ergonomics Society 57th Annual Meeting*, Oct. 1-4, 2013, San Diego, CA.

Bain, B. and Marklin, R.W. (2013). One external step and a horizontal handlebar on an aerial bucket reduces postural instability during ingress and egress. *Proceedings of the Human Factors and Ergonomics Society 57th Annual Meeting*, Oct. 1-4, 2013, San Diego, CA.

Bain, B. and Marklin, R.W. (2012). An Inside Step in an Aerial Bucket Reduces Postural Instability During Ingress and Egress. *Proceedings of the Human Factors and Ergonomics Society 56th Annual Meeting*, Oct. 23-26, 2012, Boston, MA.

Moriguchi, C.S., Carnaz, L., Miranda Jr., L. C., Marklin, R.W., and Gil Coury, H.J.C. (2012). Biomechanical analysis of loading/unloading ladder on a truck. In *Proceedings of the IEA Congress*, Feb 12-16, Recife, Brazil.

Saginus, K., Marklin, R.W., Seeley, P. and Freier, S. (2011). Effects of mobile computer locations in a vehicle cab on biomechanical loading. In *Proceedings of the Human Factors and Ergonomics Society 55th Annual Meeting*, Sept. 20-23, 2011, Las Vegas, NV.

Saginus, K., Marklin, R.W., Seeley, P. and Freier, S. (2010). Comparison of anthropometry of US electric utility field workers to North American general population databases. In *Proceedings of the Human Factors and Ergonomics Society 54th Annual Meeting*, Sept. 28 to Oct 1, 2010, San Francisco, CA..

Freier, S., Seeley, P., Marklin, R.W. and Saginus, K. (2010). Application of electric utility workers' anthropometry to clearance between vehicle pedals and adjacent structures. In *Proceedings of the Human Factors and Ergonomics Society 54th Annual Meeting*, Sept. 28 to Oct 1, 2010, San Francisco, CA.

Freier, S., Marklin, R.W. and Papanek, P. (2009). Effect of inverted V-shaped backrest of an office chair on ventilatory and cardiovascular efficiency. In *Proceedings of the Human Factors and Ergonomics Society 53rd Annual Meeting*, Oct. 20-23, 2009, San Antonio, TX.

Saginus, K., Marklin, R.W. and Voglewede, P. (2009). Dynamic modeling of hand force to close a disconnect switch at switching stations and substations. In *Proceedings of the Human Factors and Ergonomics Society 53rd Annual Meeting*, Oct. 20-23, 2009, San Antonio, TX.

Sanchez, H. and Marklin, R.W. (2008). Effect of a manual screwdriver with a pistol-grip handle on maximum torque and muscle activity. In *Proceedings of the Human Factors and Ergonomics Society 52nd Annual Meeting*, Sept. 23, 2008, New York, NY.

Wieszczyk, S. and Marklin, R.W. (2008). Industrial hand wheel valves: Effects of height and torque direction on maximum torque and muscle activity. In *Proceedings of the Human Factors and Ergonomics Society 52nd Annual Meeting*, Sept. 23, 2008, New York, NY.

REFEREED CONFERENCE PROCEEDINGS (ABSTRACTS) IN PRINT (since 2005)

Marklin, R.W. (2017). Ergonomic interventions for electric field workers. Seminar presented at Ergo-X conference, Tampa Bay, FL, June 24, 2017.

Slightam, J.E., Marklin, R.W., Nagurka, M.L. and Krishen, L. (2017). External force required to operate pistol grip control in electric utility aerial bucket. Presented at Applied Ergonomics Conference, Orlando, FL, March

28, 2017.

Marklin, R.W., Wilzbacher, J.W. and Krishen, L. (2016). How ergonomics improved occupational health in electric power industry with battery-powered tool. Presented at Applied Ergonomics Conference, Orlando, FL, March 24, 2016.

Marklin, R.W. (2010). Recommendations of alternative computer keyboards for industrial hygienists. Presented at the American Industrial Hygiene Conference & Exposition, Denver, CO, May 24-27, 2010.

Marklin, R.W. (2010). Electric utility workers are taller and heavier than typical anthropometry databases indicate. Presented at the American Industrial Hygiene Conference & Exposition, Denver, CO, May 24-27, 2010.

Marklin, R.W. Freier, S., and Papanek, P. (2009). A general-purpose office chair reduces heart rate during typical office tasks. Presented at the American Industrial Hygiene Conference & Exposition, Toronto, CANADA, June 1, 2009.

Marklin, R.W. and Weiszczyk, S. (2009). Low rolling resistance wheels reduce force to push carts. Presented at the American Industrial Hygiene Conference & Exposition, Toronto, CANADA, June 1, 2009.

Marklin, R.W. (2008). A methodology to assess musculoskeletal injury risk of workers in the electric utility industry. Presentation in the Roundtable: Exposure Assessment – Tools for Ergonomic Analysis of Highly Variable Jobs. Presented at the American Industrial Hygiene Conference & Exposition, Minneapolis, MN, June 1-5, 2008.

Wiesczyck, S., Sánchez, H. and Marklin, R.W. (2008). Effect of valve height on musculoskeletal loading of electric utility power plant electricians. Presented at the American Industrial Hygiene Conference & Exposition, Minneapolis, MN, June 1-5, 2008.

Marklin, R., Sánchez, H. and Purvis, C. (2007). Current topics in input devices and implications for future HFES standards work: Alternative pointing devices. Presented at the *51st meeting of the Human Factors and Ergonomics Society*, Baltimore, MD, Oct 1, 2008.

Marklin, R.W. (2006). Analysis of a shovel for digging wet clay. Forum (Field and Laboratory Analysis of Physically Demanding Variable Tasks in Construction and Utilities) presented at the American Industrial Hygiene Conference and Exposition, Orlando, FL, May 17, 2006.

Seeley, P. and Marklin, R.W. (2005). Cost/benefit analyses' role in ergonomic implementation. Presented at the Applied Ergonomics Conference, New Orleans, LA, March 21-24, 2005.

EXTRAMURALLY FUNDED RESEARCH PROJECTS (since 2005)

(Note: R.W. Marklin was the principal investigator on all the following projects except where noted.)

a) **Electric Power Research Institute (EPRI)**
Title of Project: *Back, Shoulder, and Neck Musculoskeletal Disorders Affecting Electric Utility Field Workers - Phase I*
b) February 1, 2018 to August 31, 2018
c) $79,376 USD
d) The objectives of this study are review the ergonomic interventions from the past eight EPRI Ergohomics Handbooks for the Electric Power Industry and identify research opportunities for future studies.

a) **Electric Power Research Institute (EPRI)**
Title of Project: *Augmented Reality Technology for Electric Field Workers.*
b) June 1, 2017 to Sept. 30, 2019
c) $199,971 USD
d) The objectives of this study are i) evaluate existing augmented reality technology and select appropriate technology for electric line workers and ii) to test how this technology affects workers' muscle loading, safety, work performance, and subjective assessment.
e) *Co-investigator: Mark L. Nagurka, Ph.D., PE*

a) **Electric Power Research Institute (EPRI)**
Title of Project: *Aerial Bucket Controls and Decision Tool to Implement Recommended Ergonomic Interventions*
b) Sept. 1, 2015 to Dec. 31, 2018
c) $211,002 USD
d) The objectives of this study are i) to redesign the pistol grip control in an aerial bucket to reduce muscle force and fatigue and ii) to develop a decision tool for electric utilities to prioritize ergonomic interventions published in the 8 previous EPRI Ergonomics Handbooks for the Electric Power Industry.
e) *Co-investigator: Mark L. Nagurka, Ph.D., PE*

a) **ISANTA (International Staple, Nail, and Tools Association)**
Title of Project: *Review of Epidemiological Studies of Pneumatic Nail Drivers*
b) Jan. 1, 2015 to July 30, 2014
c) $20,000 USD
d) The purpose of this study was to review the safety literature of pneumatic nail drivers and assess the strengths and limitations and highlight research voids.

a) **Electric Power Research Institute (EPRI)**
Title of Project: *A Systematic Method for Specification, Purchase and Upfitting of Fleet Vehicles in the Electric Power Industry*
b) Sept. 1, 2008 to June 1, 2012
c) $898,000 USD
d) The purpose of this study is to develop an efficient method for electric utilities to specify and then purchase fleet vehicles, which range from pickup trucks to aerial bucket trucks, so workers can use the trucks productively and with minimal risk of injury. This method will also minimize total cost of original vehicles and subsequent upfitting (retrofitting).

a) **Electric Power Research Institute (EPRI)**
Title of Project: *Evaluation and Design of Substations for Electric Utilities*

b) Jan. 1, 2008 to March 31, 2009
c) $54,000 USD
d) The purpose of this study is to evaluate substations to determine how physical injuries and accidents can be prevented.

a) **Electric Power Research Institute (EPRI)**
Title of Project: *Ergonomics Process for Workers in Fossil Electric Power Plants*
b) June 15, 2005 to Dec. 31, 2008
c) $468,254 USD
d) The purpose of this study is to build upon the success of the 2 previous EPRI studies for overhead and underground workers, which resulted in 3 published handbooks, and tailor an ergonomics process for electric power workers who work in fossil power plants (coal, oil or gas-powered). Two ergonomics teams will be setup at We Energies for electricians and power plant operators. The culmination of this project will be 2 ergonomics handbooks for electricians and power electricians and plant operators that will show how typical tasks can be changed to minimize the incidence and severity of work-related musculoskeletal injuries and illnesses. As with the past 2 projects, We Energies generously agreed to be the host utility for this project.

a) **Herman Miller, Inc. (Office Furniture Manufacturer)**
Title of Project: *Metabolic Study of Office Workers using an Office Chair*
b) Jan. 1, 2008 to Dec. 31, 2008
c) $76,886 USD
d) The purpose of this study is to evaluate the cardiac and ventilatory load, as measured by heart rate (cardiac) and tidal volume and respiratory rate (ventilatory), of office workers who use a new office chair.
Note: Dr. Paula Papanek was the P.I. on this project.

a) **Electric Power Research Institute (EPRI)**
Title of Project: *Survey of Best Practices – Grounding a De-Energized Overhead Line with a Ground Clamp Stick*
b) Jan. 1, 2008 to June 1, 2008
c) $12,963 USD
d) The purpose of this study is to determine the best work practice to do this task to reduce risk of injury.

a) **Electric Power Research Institute (EPRI)**
Title of Project: *Development of an Ergonomics Process for Underground Line Workers in the Electric Power Industry*
b) April 1, 2002 to March 31, 2005
c) $351,554 USD
d) The purpose of this study is to build upon the success of the EPRI study for overhead distribution line workers and tailor an ergonomics process for electric power workers who work underground. There are two types of underground electrical work – manhole and vault and direct-buried cable. Two ergonomics teams were setup at We Energies (formerly Wisconsin Electric-Wisconsin Gas). The culmination of this project was 2 ergonomics handbooks for underground workers that showed how typical underground tasks can be changed to minimize the incidence and severity of work-related musculoskeletal injuries and illnesses. One handbook was devoted to manhole, vault and conduit applications, and the other handbook focused on direct buried cable applications. We Energies generously agreed to be the host utility for this project, and they provided hourly and management personnel and financial resources for the two ergonomics teams.