



*Hazards are ever-present in the steel plant environment, and a heightened awareness and emphasis on safety is a necessary priority for our industry. This monthly column, written by members of the AIST Safety & Health Technology Committee, focuses on procedures and practices to promote a safe working environment for everyone.*

## NIOSH Ergonomic Evaluation of Musculoskeletal Disorders at a Steel Grating Manufacturing Plant

Scientists from the National Institute for Occupational Safety and Health (NIOSH) performed a Health Hazard Evaluation (HHE) in February 2008 at a company that manufactures steel grating for road bridges, industrial walkways, sidewalk vent covers and other applications. A division of the International Brotherhood of Boilermakers union and company management submitted the request to investigate the high number of musculoskeletal disorders (MSDs). Prior to the site visit, they identified three areas (barline, welding and saw) where they perceived most injuries were occurring. NIOSH investigators observed and videotaped these areas to document risk factors for work-related MSDs (WMSDs) and measured workstation heights and reach distances to determine injury risk. Employees were asked about their work and medical histories and any history of WMSDs. Investigators also reviewed injury and illness logs and workers' compensation data, and compared rates of nonfatal injuries and illnesses in this workforce with national rates for ornamental and architectural metal work manufacturing facilities.

This steel grating manufacturing plant receives coils of raw steel, runs it through a slitter machine that cuts it to various widths, and recoils it. Coils of steel are loaded into barline machines that straighten and flatten the raw material and cut it to length. Steel rods are twisted and used as cross supports for the grate. Bars (called "pitching bar") and rods are fed through hydraulic welders that weld the pieces into the grate. The grating is then cut to a specified length in the saw area. Saw employees push and pull grating toward the saw and cut it to the specified size. Final pieces are placed on pallets on the floor. Forklifts and cranes transport the steel coils and gratings through the plant, and a fabrication shop welds and assembles smaller grating and custom pieces.

NIOSH investigators found the employees at this company were at an increased risk for WMSDs due to awkward postures, forceful exertions and repetitive motions. These included prying

materials loose with pry bars, squatting and bending over at the waist and back to maneuver heavy materials (Figure 1), reaching at or above shoulder height and manipulating material using awkward shoulder and wrist postures (Figure 2). Employees reported increased musculoskeletal pain and discomfort in their back and shoulders at work. Almost half of the injury and illness log entries during the past five years were WMSDs, and most of these were in the shoulder and back. The most common job involving WMSDs was Machine Operator, and the most common work location was on the #2 and #3 welders. Lastly, rates of nonfatal injury and illness at this company were higher than national rates found in a comparable industry.

NIOSH offered several recommendations to reduce the risk of WMSDs at this company. The preferred method to control workplace risk factors is to provide engineering controls to redesign the workstation and/or job task. Administrative controls are designed to temporarily limit exposure to hazardous conditions until engineering controls are implemented. The effectiveness of administrative changes in work practices depends on management commitment and employee acceptance. Investigators also recommended changes in work practices, improving healthcare management, and encouraging employee participation in the health and safety committee. Their recommendations appear below.

### Engineering Controls

- Design horizontal work surfaces (welding loading tables, saw area pallets and catch basins) to be between 28 and 56 inches high. Moving the working height toward the middle of this range should reduce the risk for back and shoulder WMSDs.
- Install powered roller conveyors in the saw areas to eliminate pushing and pulling forces required to move grating on the conveyor.

**Figure 1**



An employee bends at the waist and back to maneuver heavy materials, increasing his chance for injury.

**Figure 2**



An employee reaches above shoulder height with awkward shoulder and wrist positions.

# ***BOLTING SAFETY, QUALITY, SCHEDULE***



**HYTORC®**  
*Since 1968*

## ***TOOL TECHNOLOGY, QUALITY, 24/7 SERVICE***

**SALES, RENTAL, LEAKAGE-ZERO GUARANTEE**

**800 FOR-HYTORC**

**WWW.HYTORC.COM**

- Replace grooved surfaces at the saw tables with a smooth surface (to eliminate material getting caught and requiring excessive push forces).

### **Administrative Controls**

- Rotate employees through jobs with different physical demands, broaden or vary job content to offset WMSD risk factors, and schedule more breaks to allow for rest and recovery.
- Decrease the amount of mandatory overtime (hire more employees, rotate employees off shifts, and allow more consistent weekend recovery time).
- Offer all employees ergonomics training.

### **Work Practice Changes**

- Barline employees should grind welds instead of using a pry bar. To facilitate this, employees in the slitter area should use a minimal weld that can be easily removed by barline employees.

- Barline employees should walk around machines to make adjustments. This eliminates extended reaches and risk of lower back and shoulder injuries.
- Saw area employees should avoid leaning forward to clean scrap from the saw (Figure 3). Instead, they should use a small hand broom to sweep scrap into the catch basin rather than leaning and sweeping it into their hands).
- Place anti-fatigue floor mats and/or footrests at each workstation to reduce muscle fatigue and lower back pain from prolonged standing (these may need to be a special material to reduce the potential for slips and falls if oils are present).
- Create a routine maintenance schedule for all equipment.

### **Healthcare Management**

- Encourage employees to report WMSDs to management and to seek care from a qualified provider.
- Consistently record WMSD cases on Occupational Safety and Health Administration (OSHA) logs to analyze trends.
- Train and educate employees to recognize signs and symptoms of WMSDs.

### **Health and Safety Committee**

- Develop a written health and safety program endorsed by management and communicated to employees.
- Encourage participation in the health and safety committee, and ask employees for ideas about how to prevent WMSDs.
- Conduct health and safety committee meetings regularly.

The full NIOSH HHE report (NIOSH 2009, "Ergonomic Evaluation at a Steel Grating Manufacturing Plant," by C. West and J. Ramsey, Cincinnati, Ohio: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, NIOSH HETA No. 2008-0074-3081) is available online at: <http://www.cdc.gov/niosh/hhe/reports/pdfs/2008-0074-3081.pdf>. ♦

— Christine West and Jessica Ramsey are employees of the National Institute for Occupational Safety and Health (NIOSH). Maureen T. Niemeier is a freelance technical writer.

*If you have questions about this topic or other safety issues, please contact [safetyfirst@aist.org](mailto:safetyfirst@aist.org). Please include your full name, company name, mailing address and e-mail in all correspondence.*

**Figure 3**



Saw employees are required to push and pull grating toward the saw in order to cut it to size.