ERGONOMICS DEMONSTRATION PROJECT

Wallboard

January 2002

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This ergonomics demonstration project was initiated with Washington State drywall business and labor representatives in July 1999. The project focused on identifying Hazard Zone risk factors and technologically feasible solutions for the major tasks associated with wallboard installers, finishers, and stockers. Risk factor exposures were compared with hazard zone limits specified in the Ergonomics Rule and technologically feasible risk reduction "solutions" were identified as possible Ergonomics Rule compliance options for employers

Field testing of the industry-specific lists of work-related musculoskeletal disorder (WMSD) risk factors identified by the project participants has been initiated, to evaluate the usefulness of the project results for employers to reduce risk factors and to comply with the Ergonomics Rule.

The following is a summary of the Hazard Zone risk factors identified by the demonstration project, as well as technologically feasible solutions for wallboard installers, finishers, and stockers.

Installers

Residential and commercial drywall installers were observed in their normal course of work, including measuring, cutting, lifting, and screwing off panels, and performing infrequent incidental stocking. The primary risk factors addressed by the Ergonomics Rule involved lifting heavy drywall panels (>90 lbs), working with the hands overhead, and the possibility of large amounts of time spent gripping a screw gun with high hand force and highly repetitive motion.

Exposures to at least some of these risk factors were high enough to be hazardous for both residential and commercial drywall installers. Commercial installers may have a higher probability of being exposed to WMSD hazards in some cases, due to their greater tendency to lift large, heavy panels for installation by themselves, and perhaps for having less natural variability in their tasks, such as workers who install lids on large projects for several days, or due to task specialization such as workers who uses screw guns as their primary task.

Lifting drywall panels was observed as a potential WMSD hazard in some cases (see Figure 1). Workers lifting panels that weigh more than 90 lbs by themselves were observed during the installation of panels, or associated panel loading onto scissor lifts or scaffolding. In most cases, risk factors from heavy panel lifting are easily reduced by one or more of the following: a) using two or more workers to lift heavier panels, b) use of a panel lift, c) proper distribution of panels around the work site to minimize the need for installers to move panels around the worksite. Table 2 lists common drywall panel types and the maximum lengths that can be lifted by a single worker without creating a hazardous exposure under the rule (greater panel lengths/weights can be lifted by two or more workers). Figures 1-5 show several commonly available lifting solutions.

Working with the hands overhead (> 4 total hours per day), high grip force (> 10 lbs per hand) by the hands, and possibly excessive hand-arm vibration, were observed as WMSDs for workers performing large amounts of screw gun use, such as workers where screw gun use is their only task.

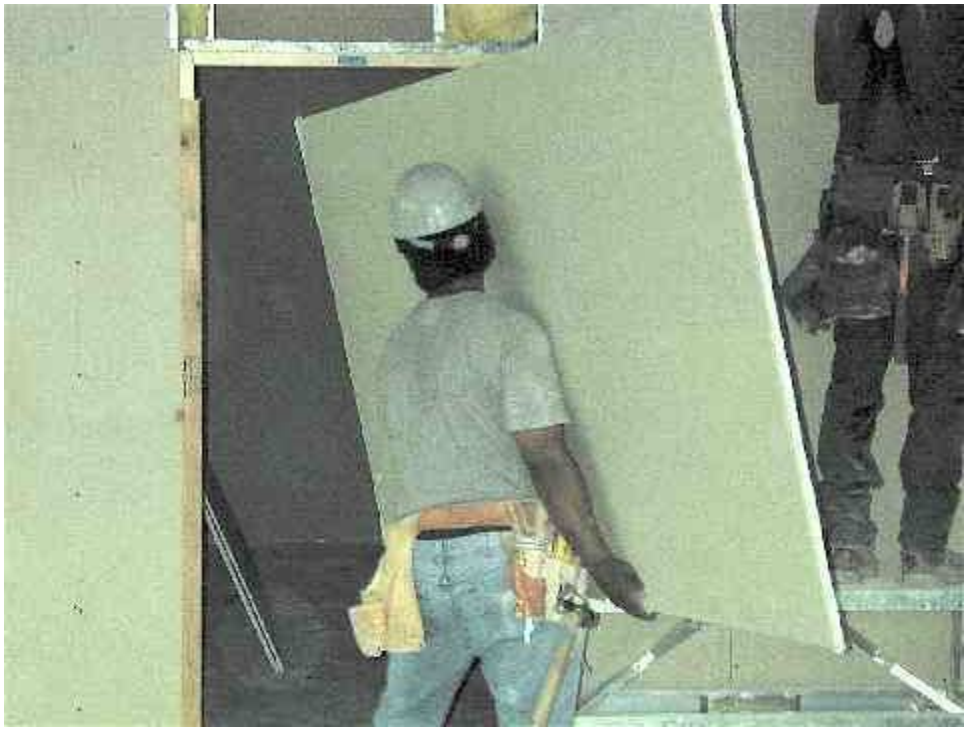

Figure 1. Lifting heavy wallboard panels for installation.

Table 1 summarizes the potential WMSD hazards, and possible solutions, for wallboard installers.

Table 1. Potential WMSD Hazards and Solutions for Installers

Risk Factor	Possible Hazard Zone Task	Mitigating Solutions
Lifting >90 lbs	Installing drywall panels	1) Use two or more workers to lift larger panels (Table 2 lists one-worker lifting limits) 2) Use a panel lift Note: for both options above: Start lift with hand height between knee and waist, close to body
	Incidental stocking onto scissor lift	1) Lift only single sheets (separate before lifting) 2) Slide panels onto lift (minimum lifting) 3) Lift one end of panel at a time (reduced effective weight) if lifted by one worker 4) Mechanical loading onto lift
	Incidental stocking onto scaffolding	1) Limit size of panels that can be lifted by one floor worker to those sizes shown in Table 2) (1 up / 1 down) 2) Use two or more worker on floor to lift larger panels (1 up / 2 down) Note: for both options above: Start lift with hand height between knee and waist, close to body
Hands Over Head > 4 hrs per day	Installing lids, soffits	1) Job rotation / task rotation 2) Use a panel lift
High Hand Grip Force (> 10 lbs per hand) with either highly repetitive motion or bent wrists > 3hrs/day	Gripping screw gun to screw off panels	1) Rotate to other installation tasks
Highly Repetitive Motion with wrists bent and forceful exertions with the hands, > 2 hrs/day (without wrists bent, > 6 hrs/day)	Screwing off panels	1) Rotate to other installation tasks 2) Limit need to bend wrists (e.g., use scaffolding at appropriate heights)
Hand-Arm Vibration (See Ergo Rule Appx B for vibration limit values) (vibration more likely a problem for older and/or not well maintained screw guns)	Screwing off panels	1) Low vibration screw gun 2) Rotate to other installation tasks

Table 2. Maximum one-worker lifting lengths for commonly used types of drywall (Installation – including Incidental Stocking)

Maximum Length of 48" Width Wallboard
(one panel) that can be lifted by One Worker
(One-worker lift)

Wallboard Type	Maximum Length
½" Regular panels	12'
½" All other types	10'
5/8" Regular panels Firecode X Firecode C	10' 10' 9'
5/8" W/R Regular Panels W/R Firecode X, C	9'6" 9'
Exterior panels	8'
Dens Glass	8'
Coreboard (shaftliner)	10'
Abuse Resistant (5/8") (1/2" only)	--- 9'6"

Note 1: All Abuse Resistant (5/8") panels must be lifted by 2 (or more) workers

Note 2: All 54" width panels must be lifted by 2 (or more) workers

Note 3: Determination of WA State Ergonomics Rule compliance for wallboard types not listed in the chart is the responsibility of the employer using the wallboard.
This includes:

- Types of wallboard not listed in the chart (all proposed lengths)
- Standard types listed in the chart that are greater than 12' length
- Standard types listed in the chart that significantly exceed current (Jan 2001) weights (determined by a representative survey of widely available vendor products)

  (A few pounds per sheet (+/-) difference between manufacturers are not of concern – significantly increased weight per sheet from the current norms will cause such sheets to be considered non-standard, and compliance will have to be demonstrated by the employer)

Acceptable demonstration of compliance for these alternative types of wallboard would include, for example, a) vendor data showing panel size(s)/weight(s), b) number of workers used to lift panels for installation, and c) Ergonomics Rule Appendix B calculation of lifting compliance.

Figure 2. Two-worker panel lifting.

Figure 3. Panel lift used to lift and hold panels.

Figure 4. Proper panel stocking distribution around the worksite -- minimizes the need for installers to do incidental stocking.

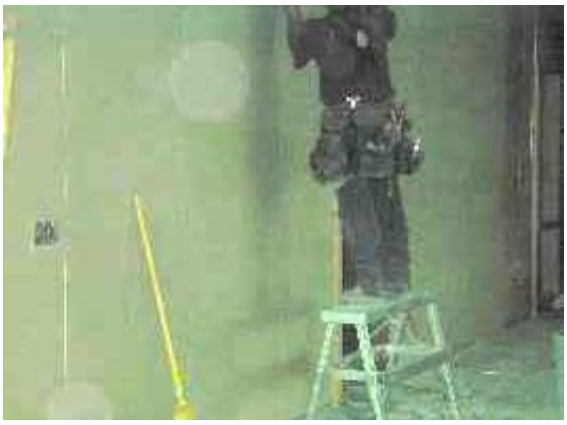

Figure 5a, 5b. Rotation from screw gun use (left) to other installation tasks (e.g., measuring/marking (right), cutting and installing panels.

Figure 6. Panel carrier handle puts hand at a good height from the floor for lifting.

Less back bending than reaching down to the floor to lift. Panel does not block worker's vision when panel is carried at this height.
Note: Good hand height for lifting the panel can also be achieved by tipping the panel up partway and grasping it underneath.

Installer risk factors not covered by the Ergonomics Rule

Table 3. Installer risk factors not covered by the Ergonomics Rule (good ideas – not required for compliance)

Risk Factors Not in Ergonomics Rule	**Task**	**Risk Reduction Ideas**
Carrying / Dragging Panels	Incidental Stocking	1) Properly distribute panels around the worksite 2) Use a panel cart 3) Move single panels 4) Use two persons to move panels
Back or Neck Bent Backwards	Lids and soffits installation	1) Job rotation / task rotation (alternate to installation on walls, etc.)
Neck Compression	Lids installation	1) Support overhead panels with hands/arms (not with hardhat) 2) Use a panel lift

Finishers

Residential and commercial drywall finishers were observed in their normal course of work, including mixing mud, using a box, bazooka, trowel, and sanding. Work was observed as performed from floor level, on stilts, as well as on scaffolding and lifts. The primary risk factors addressed by the Ergonomics Rule involved hands overhead, high hand grip force, and highly repetitive motion, when using finishing tools.
Risks were observed for both residential and commercial drywall installers. Commercial installers were found to be more likely to be at risk due to the greater tendency for workers to perform specific tasks, such as the existence of workers whose primary task is box work.

Gripping (>10 lbs per hand), highly repetitive motion, and hands overhead, were observed as potential WMSD hazards when using a box.
Gripping (>10 lbs per hand), and highly repetitive motion, was observed as potential WMSD hazards for bazooka use.
Highly repetitive motion (> 2 hrs per day) was observed as a potential WMSD hazard for trowel use.
Hands above the head (> 4 hrs/day), highly repetitive motion (> 6 hrs per day), and pinch gripping (>4 lbs per hand, > 3 hrs per day) of sandpaper, were observed for sanding work.

In most cases, WMSD hazards present in finishing tool use are easily reduced by: job rotation / task rotation (alternate between using the different tools).

High hand force hazards for box use may be reduced by use of spring-powered boxes. These boxes have been shown to require less overall muscle force to push mud out of the tool, which is likely to result in lowered hand force requirements as well. See NIOSH description for more information:
http://www.cdc.gov/niosh/elcosh/docs/d0400/d000477/d000477.html

Sanding risks can be reduced by rotation to other tasks, and by changing a pinch grip of sandpaper to a whole hand grasp of sandpaper/block (where possible). The whole-hand grip is much stronger than the pinch grip.

Figure 7. Screw gun use.

Table 4 summarizes the potential WMSD hazards, and possible solutions, for wallboard finishers.

Table 4. Potential WMSD hazards and Solutions for Finishers

Risk Factor	Possible Hazard Zone Task	Mitigating Solutions
High Hand Force -Grasp (whole hand grasping) (> 10 lbs/hand) with either highly repetitive motion or bent wrists > 3 hrs/day	Box Use Bazooka Use	1) Job rotation / task rotation (alternate between using the box, bazooka, and other tools such as trowel, sanding, etc.) 2) Consider use of spring powered box tool (reduces high hand force, as well as overall upper body force, required for pushing mud out of the box tool)
High Hand Force - Pinch (pinching with fingers) (> 4 lbs/hand) with either highly repetitive motion or bent wrists > 3 hrs/day	Sanding	1) Job rotation / task rotation (alternate between sanding and other tasks) 2) Grasp sandpaper/block, where possible, rather than pinch (grasp limit (10 lbs) is greater than pinch grip limit (4 lbs)
Highly Repetitive Motion (with wrist bent and forceful exertions with the hands) >2 hrs/day (for sandpaper use only: > 6 hrs/day)	Box Use Bazooka Use Trowel Use Sanding	1) Job rotation / task rotation (alternate between using the box, bazooka, and other tools such as trowel, sanding, etc.)
Hands Over Head (or elbows above the shoulder) >4 hrs/day	Box Use Sanding	1) Job rotation / task rotation (alternate between box use, sanding, and other tools)

Figures 8a, 8b, 8c, 8d show several different finisher tasks/tools. Rotating between tasks/tools with different risk factors can reduce risk of injury.

Figure 8a. Bazooka use.

Figure 8b. Box use.

Figure 8c. Trowel use.

Figure 8d. Trowel use.

Figure 8e. Sanding.

Figure 8(a,b,c,d,e). Finishing Tasks/Tools – Bazooka, Box, Trowel, Sanding. Rotation between different tasks/tools can be used to reduce risk factor exposures.

Finisher risk factors not covered by the Ergonomics Rule

Table 5. Finisher risk factors not covered by the Ergonomics Rule
(Good ideas – not required for compliance)

Risk Factors Not in Ergonomics Rule	Task	Risk Reduction Ideas
Stress on legs, back (especially knees, hips) from stilts use	Finishing ceilings, high walls	1) No box or bazooka use on stilts 2) Rotate to not using stilts (e.g., standing on floor or scaffold) 3) Use high quality stilts that are well maintained
High effort upper body exertion (from box use) (stresses on shoulders, back, arm, neck, etc.)	Box use	1) Rotation to other finishing tasks/tools (e.g., bazooka, trowel)

Figure 9. Stilts use – prolonged use can be stressful to legs, back.

Figure 10. Box use – prolonged use is fatiguing and can be stressful to the upper body.

Stockers

Residential and commercial drywall stockers were observed in their normal course of work, including, loading and unloading carts, lifting panels, and moving carts. Instances of both adequate hatch access and inadequate hatch access were observed. The primary risk factor addressed by the Ergonomics Rule involved heavy lifting.
Risks were observed for both residential and commercial drywall stockers. Commercial stocking typically involved large-scale deliveries to one or a few large worksites, where extensive periods of non-stop stocking occurred. Residential stocking typically involved small to medium scale deliveries, with a higher amount of the workday spent driving between multiple delivery sites. Residential stocking is more likely to encounter worksites where adequate hatch access (e.g., for second floor stocking) is not available.

Lifting drywall panels was observed as a WMSD hazard in some cases. Bundles (two panels taped together) are typically lifted by two workers. Panels are generally moved in pairs to protect the panel faces, and to reduce panel bending in the case of thinner panels. Larger/heavier bundles weigh more than 180 lbs, which results in more than 90 lbs lifted per worker when two workers are used to load/unload carts, or lift panels up to second floor levels over balconies, up stairs, etc.
In most cases, hazards from lifting heavy panels can be reduced by one or more of the following: 1) using mechanical equipment wherever possible (e.g., boom truck, panel lifts), 2) sliding, not lifting panels wherever possible, 3) using hatch accesses, (e.g., a door, window, or other opening) to reduce the need to lift panels, 4) using sufficient number of workers (team lifting) to reduce the weight lifted per worker (e.g., using two crews –2 up / 2 down, for vertical lifting of bundles up over balconies), 5) lifting single sheets, where required (splitting up pairs of panels).

Lifting of heavily loaded carts over obstacles was observed as a WMSD hazard in some cases.
In most cases, clearing paths for the carts, and using carts that can be rolled over small obstacles can reduce this risk.

Table 6 summarizes the potential WMSD hazards, and possible solutions, for wallboard stockers.

Table 6. Potential WMSD hazards and Solutions for Stockers

Risk Factor	Possible Hazard Zone Task	Mitigating Solutions
Lifting >90 lbs (heavy lifting)	Loading carts - lowering (e.g., window access hatch)	1) Teach/use proper teamwork
	Unloading carts	1) Teach/use proper teamwork 2) Consider developing experimental carts that would allow sheets to be slid off cart rather than lifted cart
	Lifting panels - vertical transfer	1) Provide adequate access to stocking areas by mechanical equipment (avoid lifting) (direct access, hatches, etc.) 2) Use mechanical equipment and panel carts wherever possible (avoid lifting/carrying) 3) Lift with 2 or more workers
	Lifting loaded carts over obstacles	1) Clear work area where carts are to be rolled 2) Use carts with wheels that can roll over small obstacles without damage 3) Protect cords (e.g., use small piece of plywood laid over cords, so carts can roll over 4) Pull down on panels on one end of loaded cart to lift opposite end over obstacles

Figure 11. Teamwork used for loading carts via hatch access.

Figure 12. Lack of hatch access requires lifting panels up to second floor.

Figure 13. Rotation from stocking (lifting panels) to boom truck operation (for stockers trained for boom truck operation).

Stocker risk factors not covered by the Ergonomics Rule

Table 7. Stocker risk factors not covered by the Ergonomics Rule
(good ideas – not required for compliance)

Risk Factors Not in Ergonomics Rule	**Task**	**Risk Reduction Ideas**
High push/pull forces from loading carts (sliding panels)	Loading panels onto carts	1) Use low friction sliding surfaces on carts and boom truck forks, and maintain these sliding surfaces 2) Use carts capable of rolling over small obstacles, and maintain these wheels for easy rolling
Fatigue from heavy lifting without rest breaks (continuous stocking)	Loading, unloading carts, pushing carts	1) Rotate beteen lifting and non-lifting tasks (e.g, between cart loading/unloading and boom truck crane operation) 2) Take short work breaks during large deliveries where rotation is not possible (e.g., when only one worker is trained for boom truck crane operation)

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