

Naval Facilities Engineering Command Ergonomic Risk Assessment

Introduction

This report summarizes the ergonomic risk assessment conducted in January of 2004. The boat repair and recycling center were observed in order to determine sources of ergonomic stress and recommend improvements. This assessment is based upon interviews with supervisor, safety specialist, and employees as well as an evaluation by the Naval Facilities Engineering Command (NAVFACENGCOM) Hazard Abatement Ergonomist.

The BOAT boat repair and recycling operations were observed in order to determine sources of ergonomics stress and make recommendations to reduce the risk of work-related musculoskeletal disorders (WMSDs) and improve safety, health and productivity. Musculoskeletal Disorders (MSDs) are injuries and illnesses that affect muscles, nerves, tendons, ligaments, joints, spinal discs, skin, subcutaneous tissues, blood vessels, and bones. Work-Related Musculoskeletal Disorders (WMSDs) are:

- Musculoskeletal disorders to which the work environment and the performance of work contribute significantly or
- Musculoskeletal disorders that are aggravated or prolonged by work conditions.

Recommendations to the command to further reduce the probability of injury include new equipmentⁱ and administrative controlsⁱⁱ. Recommendations are included with as much vendor informationⁱⁱⁱ as possible to assist in the evaluation of products and services. Input gathered from the workers, safety specialists, and other personnel to evaluate equipment before purchasing is recommended. This process will increase product acceptance, test product usability and durability, and take advantage of employee experience.

Hazard Abatement funding has been approved for FY05 for the recycling center and BOAT boat repair under Projects 660AC and 661AC. Naval Facilities Engineering Command (NAVFACENGCOM) manages the CNO Hazard Abatement Program, which is a centrally managed fund to correct safety and health deficiencies beyond the funding capabilities of the activity. Information about the HA program can be found on the Naval Facilities Engineering Command web site www.navfac.navy.mil/safety and in OPNAVINST 5100.23F. Ch 12 Hazard Abatement.

Boat Repair

Purpose of the Operation: Responsible for repairing boats used for training and studies.

Population: 60 civilians

Injury Data: Two (2) recent lengthy lost workday mishaps were directly attributable to the awkward lifting requirements of this operation. Over 90 percent of civilian mishaps in this operation are back or sprain related.

Description of the Operation:

Every time a boat is brought in for repair, it has to be lifted out of the water with a winch. In order to avoid damaging the boat, fenders are lowered over the boat sides to protect the vessel. The fenders rest between the boat and the straps raising or lowering the vessel. Boats are lowered or raised about 40 to 50 times each year.

Ergonomic issue description:

Heavy and Repetitive Lifting combined: Workers attach 10 fenders per boat, each weighing about 100 lbs. Workers have to carry the fenders from the forklift to the side of the boat, figure 1, and then lean over the side of the boat, figure 2, to raise and lower the fenders into position, placing extreme stress on the back and upper extremities. Repetitive lifting combined with awkward postures can place the worker at risk of back strain or injury. When the fenders are removed, they have to be lifted up from the water. The fenders tend to absorb water, increasing the weight of the load and the force required to lift them. The lifting and lowering of the fenders could not be evaluated by any recognized ergonomic lifting assessment tools because of the constraints of the lift and the high hazard level involved.

In addition to attaching fenders, numerous operations related to boat repair involve lifting and handling heavy equipment such as engine components, industrial supplies, large marine batteries and electronics/IT equipment. About 80 engine heads and 800 batteries are handled annually for repairs. Engine heads are brought in for repair, as shown in figure 3. Each boat has 4 engine heads. Each engine head weighs 250 lbs. and arrives on pallet where it is manually lifted to a work table. Each boat has 6 batteries which have to be changed about 6 times a year. Batteries are manually moved around the repair shop, as shown in figure 4. Marine batteries weigh 164 lbs. or 176 lbs. depending on type. According to the National Institute of Occupational Safety and Health Revised Lifting Equation, nearly all healthy workers can lift up to 51 lbs. in ideal lifting conditions over a substantial period of time without increased risk of lower back injury. The employees regularly perform lifting tasks greater than 51 lbs. in less than ideal conditions. The work force repairing batteries is mixed male and female. According to Mil-STD 1472F, a mixed male and female population shouldn't lift more than 44 lbs from the floor to a surface less than 36" above the floor. The engine repairs are performed by a male population. An entirely male population can lift up to 87lbs from the floor to a surface less than 36" above the floor. The workforce is exceeding the recommended weight for lifting, which places them at risk of injury.

Photos removed

Figure 1: Carrying fenders

Figure 2: Lowering fenders





Figure 3: Heavy lifting in engine repair

Figure 4: Lifting marine batteries

Recommendations

- Recommend aluminum fenders to decrease the weight by about 75%. Lighter fenders will reduce the stress on the back associated with lifting and lowering. Aluminum will keep the fenders from retaining water in order to keep the weight constant. A quote for 18 fenders 11.5" in diameter and 60" long of 3/16" Aluminum construction with an eye hook at each end, weighing 27 lbs. was obtained for \$13,856 with shipping.
- Obtain material handling equipment to reduce manual lifting of items being repaired. Hydraulic height adjustable carts and an engine hoist will reduce lifting in the battery and engine repair shops. Refer to Table 1 for vendor information.

Table 1: Material Handling Equipment				
Description	Vendor	Product	Estimated Cost	Figure

Height Adjustable Carts *price depends on size	Lab Safety 1-800-356-0783	Bishamon Mobile Scissor Lift Tables 330 lb. Capacity #18771	\$560	
	Grainger 757-855-3153	Manual Hydraulic Elevating Scissor Cart 400 lb. Capacity #3KR46	\$378	
	Global Equipment 1-800-645-1232	Scissor Lift Table 660 lb. Capacity #GK954850	\$367	
	C&H 1-800-558-9966	Mobile Scissor Lift Truck 330 lb. Capacity 71-525A	\$568	
Mobile Hydraulic Crane	Grainger 757-855-3153	Hydraulic Engine Mobile Crane Hydraulic Space Saver Engine Mobile Crane, Capacity 2200/1650/1100 Pounds,	\$516	
	Global Equipment 1-800-645-1232	Mobile-telescoping, crane. Heavy-gauge steel. Folds to a compact 62 1/2"H x 32 1/2"W x 39"D. Manual hydraulic pump and 11" hook chain allow multiple uses. Telescoping four-position boom has 1000-4000 lb. capacity range.	\$239	
	Peak Logix	Mobile Hydraulic Crane, 2,000 lb capacity with boom fully extended to 84". Lift height is 96" to 126". Narrow aisle capacity.	\$1100	

Recycling Center

Purpose of the Operation: Process recyclable materials for the activity

Population: 4 civilian employees

Injury Data: No recorded injuries

Description of the Operation:

Employees in the recycling center are responsible for processing cardboard and paper products for the activity.

Ergonomic issue description:

Forceful Exertions and Heavy Lifting: Items to be recycled arrive by dump truck, carts and large cardboard cartons known as gaylords, figure 5. Employees have to move and push over heavy cardboard gaylords which are frequently degraded due to wear and exposure to moisture. The gaylords are over three and half feet tall which makes reaching into them extremely difficult. About 30 gaylords are dumped every month. Exerting high forces can contract muscles to their maximum capability which can lead to fatigue and possible damage to the muscles and other tissues. Heavy lifting can strain the back and place the worker at risk of injury.

Repetitive Motions and Awkward Postures: Employees have to tilt the carts up in order to retrieve items at the bottom, placing strain on the lower back, figure 6. Tilting a cart on two casters presents a safety hazard because it reduces cart stability. Reaching into the cart to retrieve materials forces the worker to lift in an awkward posture which increases stress on the spine. Sorting materials for recycling requires the worker to stand for long periods performing repetitive hand/arm/wrist motions combined with extended reaches and bending of the torso, figure 7. Risk factors occurring in combination increase the risk of developing WMSDs.



Figure 5: Cardboard Gaylord



Figure 6: Reaching into hamper



Figure 7: Sorting materials for recycling

Recommendations:

- Collapsible containers with a drop side and a skid bottom to eliminate reaching into and dumping of gaylords. Refer to table 2.
- A hamper dumper (mobile tilting skid lift) to move the collapsible containers and tilt them for dumping. Refer to table 3.
- Hampers with platform lift bottoms which will raise as material is removed in order to eliminate reaching into the bottom of the carts. Tilting carts will also help the workers reach materials at the bottom. Refer to table 4.

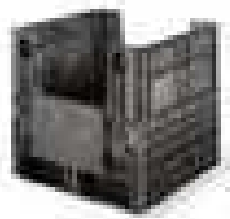
Table 2: Collapsible Containers				
Description	Vendor	Product	Estimated Cost	Figure
Collapsible Containers	Grainger	Plastic Collapsible Container, Capacity 1500 Pounds, Volume 41.7 Cubic Feet, Exterior Height 46 Inches, Interior Height 41 Inches, Color Blue, External	\$267.50	
	Lab Safety 1-800-356-0783	Collapsible Bulk Box, 1800-lb. Capacity, 2 Gates, 34"H x 45"W x 48"L	\$249	
	C&H Distributors 1-800-558-9966	Heavy-duty collapsible, capacity of 2000 lbs. 48x45x34"	\$249	



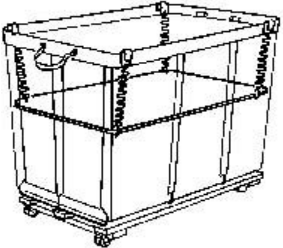


Table 3: Hamper Dumper				
Description	Vendor	Product	Estimated Cost	Figure
Hamper Dumper	C&H 1-800-558-9966	Hydraulic Akro-Lift	\$3557	
	Lab Safety 1-800-356-0783	Hydraulic Akro-Lift	\$3795	
	Grainger	Easy mobile tilter	\$2764	

Table 4: Hampers				
Description	Vendor	Product	Estimated Cost	Figure
Hampers with platform lift bottom	Postal Products Unlimited 1-800-229-4500	Elevated Basket Truck	\$70-\$85	
	Postal Products Unlimited 1-800-229-4500	Basket Truck Elevated Spring Platform	\$129- \$218 \$36-\$61	
	Postal Products Unlimited 1-800-229-4500	Heavy-Duty Spring Loaded Mail Cart	\$349	
	Grainger	Mail Hamper Spring Platform	\$182- \$335 \$144- \$151	
	McClure Industries 1-800-752-2821	Spring Platform Cart	\$355- \$632	
	Datamation Systems, Inc 1-201-732-3824	Ergonomic Auto Level Cart	\$935	
	Charnstrom 1-800-328-2962	Mail Hamper Spring Platform	\$198- \$274 \$60-100	
Tilt Truck	Grainger	Tilt Truck Maximum Load 850 Pounds, Wheel Size 12 Inches,	\$430.50	

	<p>Lab Safety 1-800-356-0783</p>	<p>Rubbermaid® Ergonomic Tilt Truck, 42-1/4"H x 33-1/2"W x 70-3/4"L, 1000 lb. Capacity</p>	<p>\$666</p>	
	<p>C&H distributors 1-800-558-9966</p>	<p>Rubbermaid 600 lb. capacity</p>	<p>\$379</p>	

*Some information has been removed from this report that is specific to the activity.

ⁱ Equipment purchase without proper and repeated training will not mitigate risk and may in fact increase hazards.

ⁱⁱ Administrative controls are management-controlled work practices and policies designed to reduce exposures to work-related musculoskeletal disorders (WMSDs) hazards by changing the way work is assigned or scheduled. Administrative controls reduce the exposure to ergonomic stressors and thus reduce the cumulative dose to any one worker. Examples of administrative controls that are used in the ergonomics context are employee rotation, employer-authorized changes in the pace of work, and team lifting.

ⁱⁱⁱ This report does not constitute an endorsement of any particular product. Rather, it is a recitation of how Navy personnel have addressed a particular work place safety issue. Neither the Navy nor its employees and agents warrant any product described in this report for any use, either general or particular.