

PROTECTING OUR PEOPLE FROM BAD VIBRATIONS

Some potentially serious occupational hazards in Navy workplaces, like noise-induced hearing loss and heat stress, are well known, heavily



A seaman uses a pneumatic sander to prepare metal framing for painting.

reported, and well documented. However, certain other workplace hazards, some of which can produce serious, irreversible, and unsuspected diseases are not as widely recognized. One such hazard is hand arm vibration, which can cause hand arm vibration syndrome, or HAVS.

A 1918 study by Dr. Alice Hamilton found that 80 percent of the workers in an Indiana limestone quarry were affected by HAVS. The National Institute for Occupational Safety and Health (NIOSH) studied the same operation 60 years later, in similar Indiana quarries, and found the same incidence of HAVS, with “no change in the design of the air hammers used for stonecutting.” Some of the individuals NIOSH studied were the grandsons of workers evaluated in 1918.

HAVS, previously known as Reynaud’s syndrome, is a medical condition that can lead to permanent disability. HAVS is caused by people’s hands being exposed to chronic vibration, which damages the nerves, blood vessels, and bones. Exposure to cold temperatures also increases the probability of acquiring HAVS and the likelihood of exhibiting symptoms. *[An estimated 2.5 million U.S. workers are exposed daily to some level of hand-arm vibration from the power tools they use on their jobs. Navy civilian and military personnel involved in defense-support operations may be exposed to such hazards. See *Vibration* at: http://www.public.navy.mil/navsafecen/Pages/acquisition/vibration_acquisition.aspx]*

Most occurrences of HAVS affecting Navy personnel involve workers who use gasoline, pneumatic, hydraulic, or electric vibratory tools, such as grinders used for surface preparation or rivet guns and bucking bars for airframes maintenance. These tools are common in Navy shipyards, aircraft-maintenance shops, and other environments such as construction sites and foundries.

Potential HAV Exposures and Tasks Relevant to U.S. Navy		
Task	Type of Tools	Remarks
Dismantlement of ships, particularly submarines	Electric and pneumatic cutting tools, grinders and electric saws	The presence of hazardous materials often prevents use of torch cutting to dismantle vessels. This forces the use of hand tools to cut metal sections. Significant vibration exposures have been associated with this work because of duration, tool size, and substrate and work postures.
Paint removal/surface preparation	Hand grinders, needle guns, hydroblast nozzles, abrasive blast nozzles	Heavy metal lead exposure can also affect peripheral nerve conduction and may have an additive neurological effect.
Preparation of welding surfaces - pre-cleaning or smoothing after welding	Hand grinders	
Foundry cleaning departments. Removal of burrs and projections on newly cast work	Grinders, chippers	Improved quality control can reduce need for finishing and cleaning. Silica exposure also may be an issue.
Sheet metal and fiberglass work	Hand grinders, orbital sanders and polishers	
Road repair	Jackhammers	Much of the noise and vibration are associated with air-blow off and escape post tool impact. Devices controlling exhaust and recoil control exposure with minimal or no effect on productivity.
Forestry (chain saw use)	Chain saws	Tool maintenance increases safety while reducing vibration. Cold is an additional hazard to hands.

Historically, there has been inconsistent and often limited progress in eradicating, or even recognizing the HAVS problem. Puget Sound Naval Shipyard & Intermediate Maintenance Facility (PSNS & IMF) in Bremerton, WA was one of the first Navy activities to look at issues involving hand-arm vibration. Early in the 1990's many of the jobs at PSNS & IMF that used hand held power tools were labor intensive. The safety office evaluated some of these jobs by slow motion videotaping workers using power tools, since vibration measuring instruments were not available at the time. As a follow on effort, PSNS & IMF made a considerable effort to evaluate the [ergonomics](#) of hand held tools and the benefits of anti-vibration gloves.

Mindful of the need for further study, the Defense Safety Oversight Council (DSOC) initiated a project in 2007 to address the root causes of HAVS:

http://www.public.navy.mil/navsafecen/Documents/acquisition/Vibration_Talk_DOD_IH_Forum_2008-finalJun08.pdf.

The Council collaborated with the General Services Administration (GSA) and the National Institute for Occupational Health and Safety (NIOSH) to provide guidelines for low-vibration and other ergonomics characteristics in procurement criteria for new power hand tools. A concurrent effort worked to identify and incorporate International Organization for Standardization (ISO) 10819 and American National Standards Institute (ANSI) S2.73 certified anti-vibration gloves into the federal procurement process.

A working group with Department of Defense (DoD)/GSA/NIOSH and U.S. Coast Guard members was formed. The Navy was recognized as a leader within DoD in identification of HAVS having a focused effort within several fleet concentration areas. PSNS & IMF, Naval Base San Diego, and the Navy Fleet Readiness Center, East (Cherry Point, NC) provided leadership and technical support in their areas of expertise for this project. Procurement criteria for anti-vibration gloves, low-vibration tools, and third-party certification guidelines were developed.



Builder from Naval Mobile Construction Battalion Four Zero breaks apart the asphalt with a jackhammer on a road repair project.

As a result of the DSOC project in September 2009, three low-vibration* hand tools were introduced into the federal supply system:

- Pneumatic riveting hammer, described as HAMMER, PNEUMATIC, PORTABLE 5130-01-5716908. Its vibration ($<2.5 \text{ m/s}^2$) is less than half the level created by many legacy tools.
- Pneumatic reciprocating saw, listed as SAW, RECIPROCATING, PNEUMATIC 5130-01-572-5529. Its vibration ($<4 \text{ m/s}^2$) is less than half the level created by many legacy tools.
- Needle scaler (needle gun), listed as SCALER, PNEUMATIC, PORTABLE 5130-01-317-2453. To date, GSA has been unable to

specify a maximum vibration level for this tool. However, one vendor's product, which served as a guide for the item specification, reportedly had vibration levels in the range of 3.5 meters per second, also considerably lower than many legacy products.

** Vibration measurements are well below exposures associated with many legacy products. The European standard for hand-arm vibration is an 8-hour time weighted average acceleration (change in direction of motion) exposure of 5 meters/second. The American Conference of Governmental Hygienists (ACGIH) standard is 4 m/s for an 8-hour time weighted average, and related reduction in allowable exposure time for increased vibration exposures (See the DOD Ergonomics Working Group News, Issue 55, August 2006 www.ergoworkinggroup.org)*

For more information on tool selection and the relative noise and vibration levels created by a number of common products, see <http://wwwn.cdc.gov/niosh-sound-vibration/>.

With input from Navy subject matter experts, GSA is continuing to incorporate low-vibration and other ergonomics characteristics into



Operations Specialist wears certified anti-vibration gloves while using a needle gun to chip paint off a bulkhead.

procurement criteria for new and updated power hand tools.

Collaboration with the Navy Clothing and Textile Research Facility in Natick, MA; the Defense Logistics Agency; and support from the office of the Secretary of Defense for Manpower, Personnel and Readiness ([See OSD MPR Memo of 15 Dec 09; Prevention of Vibration-Induced Hand and Arm Injury](#)) resulted in the

introduction of certified anti-vibration gloves into the federal

supply system. These gloves are labeled “meets ANSI S2.73/ISO 10819.”

Only full-finger protected gloves are tested since HAVS always begins at the fingertips and moves toward the palm. (Finger-exposed “half-finger” gloves are not recommended.) Using certified anti-vibration gloves alone will not solve the HAV problem, and the Navy recommends that the gloves be used in combination with low-vibration tools such as the ones listed above, worker education, and appropriate work practices.

A guide for users of anti-vibration gloves has been posted on the DoD Ergonomics Working Group website at:
<http://www.ergoworkinggroup.org/ewgweb/SubPages/ProgramTools/Publications/2005Pubs/98DODEWGNNews.pdf>

Caution: Those obtaining anti-vibration gloves through the federal stock system must ensure that products ordered specifically indicate certified anti-vibration gloves, as certain legacy products don't meet these criteria. These requirements must be clearly communicated and explained to procurement/supply representatives to justify the slightly greater cost of suitable protective equipment versus legacy products which cannot be verified to meet relevant performance standards.

The Navy, in conjunction with the U.S. Army Center for Health Promotion and Preventive Medicine, has also developed guidelines for workers and supervisors on the use of low vibration tools and anti-vibration gloves to protect Navy workers from hand-arm vibration exposures as shown below:

Guidelines to Protect Navy Workers from Hand-arm Vibration Exposures:

- Workers and their supervisors should ensure use of appropriate work practices and protective equipment. These include:
 - Use of certified ANSI S2.73/-ISO 10819 (third party tested) anti-vibration gloves (many models are now available within the federal supply system)
 - Use power tools with reduced-vibration characteristics
 - Keep fingers, hands, and the body warm
 - Do not smoke (Nicotine in tobacco constricts the blood vessels and can reduce circulation in the fingers).
 - Let the tool do the work, grasping it as lightly as possible, consistent with safe work practices
 - Keep tools well-maintained
 - For pneumatic tools, keep the cold exhaust air away from fingers and hands

Guidelines to Protect Navy Workers from Hand-arm Vibration Exposures (continued):

- Take breaks from tool use for at least 10 minutes per hour to allow circulation to recover
 - Wear hearing protective equipment as appropriate (Most operations producing significant hand-arm vibration are also noisy)
 - Have your vibration exposure evaluated by a professional if you feel you are exposed to high levels of vibration
 - If signs and symptoms of HAVS appear, seek medical help
- Work with your supply points of contact and process managers (engineers, shop supervisors, and technical authorities) to specify and order suitable low-vibration tools and certified anti-vibration gloves. ***The continued and expanded availability of these products will depend on user demand.***
- Report concerns and worker complaints to the appropriate industrial hygiene and occupational health professionals through your safety office. Specialized assistance, such as that provided by the Navy and Marine Corps Public Health Center may be beneficial.
- Review your process specification and technical manuals. If you feel that low-vibration tools and/or anti-vibration gloves might be considered for the relevant processes, use the comment sheet, typically on the last page of nearly every DoD/Navy technical manual, to describe potential issues and concerns. ***Remember that informed user feedback is the basis of progress and protects users and sustains the warfighter and support personnel while enhancing the Navy's mission.***

The Navy faces the continual challenge of finding better and improved vibration-reducing materials and technologies that meet ANSI/ISO guidelines and standards and can be incorporated into ships and shore facility designs during the acquisition process. Because Navy leadership is concerned about the safety and health of its military and civilian workers, they are working hard to address HAVS as an under-recognized occupational health problem through acquisition of safe, cost-effective, and performance-improving designs and equipment.