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### The U.S. Naval Supply Systems Command/Navy Clothing and Textile Research Facility (NAVSUP/NCTRF) and National Institute for Occupational Safety and Health (NIOSH) Partnership for Improving Protection from Work-Related Hand-Arm Vibration Syndrome (HAVS)

Ren Dong<sup>1</sup>, Daniel Welcome<sup>1</sup>, Xueyan Xu<sup>1</sup>, Christopher Warren<sup>1</sup>, Thomas McDowell<sup>1</sup>, Susan Krantz<sup>2</sup>, Mark Geiger<sup>3</sup>, Gavin Burdge<sup>4</sup>

<sup>1</sup>NIOSH Health Effects Laboratory Division, Morgantown, WV, USA, <sup>2</sup>U.S. Navy Clothing and Textile Research Facility, Natick, MA, USA, <sup>3</sup>Naval Safety Center Liaison Office, Arlington, VA, USA, <sup>4</sup>BMT Designers & Planners, Inc., Arlington, VA, USA

#### Abstract

To help reduce the incidence of HAVS in Department of Defense (DoD) heavy equipment/aircraft maintenance facilities and shipyards for workers using vibratory tools, NAVSUP/NCTRF entered into an agreement with the NIOSH Physical Effects Research Team, Engineering and Control Technology Branch, Health Effects Laboratory Division to study hand-transmitted vibration exposure. The agreement involves developing a means to improve the process the DoD uses in selecting powered hand tools and anti-vibration gloves, which can help minimize the risk of HAVS, a debilitating neuro-sensorial and vascular occupational disease.

As a part of the agreement, NIOSH completed a laboratory study to identify effective commercially-available gloves which can reduce hand-transmitted vibration exposure during the use of vibratory tools. Specifically, this study measured the vibration transmissibility functions of eight glove models relative to different vibratory frequencies. Results were used to identify the gloves that meet the testing criteria of the international standard ISO 10819 (1996). In addition, this study also measured the magnitude of the reduction in grip strength associated with the use of the tested gloves.

The results of this study confirmed that the vibration isolation effectiveness of the gloves was frequency-specific. While the gloves did not significantly reduce vibrations at frequencies below 25 Hz, they provided some reduction of the vibration transmitted to the palm of the hand. Glove effectiveness generally increased with the increase in vibration frequency. Effectiveness also varied significantly among the glove models, primarily depending on the isolation materials of the gloves. This study also found that these gloves reduced grip strength by more than 33%, compared with the bare-hand grip strength.

A reduction in grip strength would require a more forceful tool grip, which has been associated with an increased potential for carpal tunnel syndrome and other disorders. Thus, it is highly desirable for anti-vibration gloves to significantly reduce vibration without substantially increasing the grip effort. Based on this expectation, the tested gloves were ranked in terms of vibration attenuation and grip strength reduction, and the most effective models were identified. The results of this study also suggest that anti-vibration gloves should not be recommended for the operation of low-frequency tools such as sand rammers, tampers, and vibratory forks.

As another important output, the study led to some substantial improvements of the standardized method for testing anti-vibration gloves, which have been adopted in the revised version of ISO 10819:CD (2010). Furthermore, the transmissibility functions measured in this study can help facilitate decisions for selecting gloves for use with specific tools.

A proposed follow-on study will look at the powered hand tools used at four DoD equipment maintenance facilities and determine recommendations for ways to minimize HAVS risks.



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